HORTICULTURAL ABSTRACTS.

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Abstracts. Initialled abstracts in this number are by M. H. Moore, H. M. Tydeman and H. Wormald, of the East Malling Research Station, and by H. van der Lek of Wageningen.

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Horticultural Abstracts

Vol. III December, 1933 No. 4

HORTICULTURE—MISCELLANEOUS.

436. WARD, J. F., AND OTHERS. 634.1/2-1.4

West Cambridgeshire fruit-growing area.

Min. Agr. bull. **61**, 1933, pp. 83, bibl. 29 and 33.

This is described as a survey of soils and fruit, 1925-1927. An account of the soils of the district is followed by a short history of fruitgrowing in Cambridgeshire together with notes on cultural practices. An extremely interesting section is devoted to the actual fruits grown and the relation existing between soil types and variety and species of fruit grown. Plums are the most important top fruit grown and are followed closely by apples, cherries and pears being a long way behind. [In this connection, however, it would seem a little venturesome to draw conclusions as to the relation between soils and fruit production, while disregarding the important factor of stock influence.—ED.] Of small fruits strawberries are much the most important, being grown on the heavier types of soil. Other important crops are gooseberries mainly on light and medium gravel soils and on sandy loams, red currants on much the same soils but to a more limited extent, black currants on medium and heavier soils, raspberries on medium textured soils not subject to drought in summer.

437. CURRENCE, T. M. 631.53 : 631.588.1

Methods of supplying electric heat to hotbeds.

Univ. Minnesota Agr. Exp. Sta. bull. **289**, 1932, pp. 19, bibl. 5.

Four systems were tried at the University farm, one in each of the 4 equal divisions of a frame. Section A was heated and illuminated by 4 100-watt Mazda lamps attached to a cross piece of ½-inch pipe 12 inches above the soil. Lamps were equipped with 6-inch shallow cone reflectors. Section B. 200 watts of heat were generated by 120 ft. of hotbed cable, while a further 200 watts were used by 4 50-watt Mazda lamps suspended as before. Section C. 60 feet of hotbed cable supplied 400 watts 6 inches below soil surface. Section D. 60 feet of hotbed cable was attached to the inside walls of the frame. It was found possible to provide sufficient heat by any one of these methods. Radish and lettuce plants attained the largest size in sections supplied with artificial light at a time when the weather was very cold, the outside temperature during the period in question, 6 weeks, averaging 19·7° F. In a second experiment which followed immediately after this in warmer weather musk melons, tomatoes, egg plants and peppers were the subject of experiment. The amount of current needed for germination was less in the frames where heat was applied in the soil. Growth was best in the sections equipped with lights. [For English work on the subject the reader should see Cameron Brown's article, abstracted *H.A.*, 1933, 3 : 3 : 349.—ED.]

438. SIMONET, M. 576.312 : 581.143
Polyploidie accompagnée de gigantisme chez les plantes horticoles. (**Polyploidy attended by gigantism in horticultural plants.**)
Proc. Xth Int. Hort. Congr., Paris, 1932, Société nationale d'horticulture de France, rue de Grenelle 84, Paris 7e, pp. 197-208, bibl. 18.
The writer after discussing previous work on gigantism in plants and its connection with polyploidy describes his own observations on garden irises, triploid, tetraploid and pentaploid, and on various species of *Iberis*. It is found that the inducement of increased chromosome numbers in a plant usually results in increased size of cells. Whether this results in increased size of plant depends on whether the actual number of cells formed remains the same or decreases, as is sometimes the case. The origin of abnormal nuclei containing irregular or increased numbers of chromosomes may be due to external factors, such as heat, parasitic attack, etc., or to internal and genetic factors. Experimentally a multiplication of the number of chromosomes has fairly often been obtained as the result of crossing, following chromosomic aberrations produced during maturation divisions. The author considers that cytology and breeding offer great hopes of obtaining giant flowers and fruits in the not too distant future.

439. BEATTIE, J. H. 581.084.2 : 633.43+635.25
The significance of plot size and shape in relation to field trials with carrots and onions.
Proc. Xth Int. Hort. Cong., Paris, 1932, Société nationale d'horticulture de France, rue de Grenelle 84, Paris 7e, pp. 160-78, bibl. 7.
Biometrical studies with carrots and onions on peat soils over a period of three years and involving about 9,240 measurements and 464,000 plants indicate that about three-fourths of the total reduction in the error of a single determination for rows from 10 to 160 feet long occurs between 10 foot and 60 foot rows. The study also shows that short rows side by side give a greater reduction than do single rows of the same total length. Studies of the degree of replication needed to show significance of some predetermined percentage showed that under the conditions of this work the small plot replicated as indicated by these data is more economical of land than the larger plots. It was also shown that the rectangular multiple row plot is more economical of land than is the long single row plot. Finally it is apparent that the degree of replication needed to yield a certain predetermined result can be predicted only within rather wide limits. [Author's summary.]

440. HOLBERT, J. R., AND OTHERS. 632.11 : 621.57
Portable refrigeration chambers for studying cold resistance of plants in the field.
U.S. Dept. Agr. circ. **285**, 1933, pp. 28.
This circular describes a transportable apparatus which was made in order to expose maize plants to various temperatures for different periods of time. It consists of (1) the chambers proper with electric refrigeration units, coils and controls, (2) derricks including hoists and tracks, (3) shed, (4) additional equipment for moving and operating the apparatus. The method of operation is described in detail. [It would appear possible to test hardiness of grape vines and other bush plants in such a way.—ED.]

441. TURNER, J. H. 581.142
The viability of seeds.
Kew Bulletin Misc. Inf., No. **6**, of 1933, pp. 257-69, bibl. 39.
Much information bearing on the viability of seeds of a great number of plants is here summarized, those seeds whose powers of germination seem unimpaired after long periods receiving particular attention. The record for longevity is reached by seeds of *Nelumbo nucifera*, Gaertn (Lotus), when Ohga* obtained approximately 100 per cent. germination with the seeds of this water plant

* Ohga, I., *Bot. Mag.*, Tokyo, 1923, 37 : 87-95.

which were estimated from their position in the soil strata when found and from other evidence to be certainly 150 and probably 400 years old. Instances are given from various writers of the longevity of many kinds of seed. It is pointed out, however, that with estimations of longevity derived entirely from the circumstances in which the seeds were found there is always the possibility of error and that experiments such as those conducted by Beale* (1879) and by Duvel† (1902) are necessary. These in the main consisted of enclosing various kinds of seeds in uncorked bottles, or, to procure more natural conditions, mixed with heavy clay soil in earthenware pots covered with porous saucers, and burying them at various depths below ground. From Beale's experiments so far the following have germinated after 50 years, *Brassica, Oenothera, Polygonum, Rumex, Verbascum*, and of those laid down by Duvel the reports up to 1923 showed that 51 species out of 107 gave good germination after 20 years. The most deeply buried seeds appeared on the whole to maintain their vitality the longest. The author has raised seeds of various types of *Leguminosae* which had been preserved in loosely corked bottles in the Museums at Kew since 1842. Cereals are shown to have a relatively short life and the stories of the germination of wheat from undisturbed ancient Egyptian tombs may be discounted. The seeds of cultivated plants of all kinds appear to retain their vitality when buried in the soil for a much shorter period than do uncultivated " weeds ".

The following are also noted :—

GARNER, W. W. **Comparative responses of long-day and short-day plants to relative length of day and night.** *Plant Physiol.*, 1933, **8** : 347-56, bibl. 2.

KEEN, A. B. **Experimental methods for the study of soil cultivation.** *Empire J. of Experimental Agriculture*, 1933, **1** : 97-102. [An article of much practical utility.—ED.]

TREE FRUITS, DECIDUOUS.

Varieties, Breeding.

442. GREATOREX, F. J. 634.23

Cherry growing in Victoria.

J. Dept. Agr. Victoria (Australia), 1933, **31** : 429-37.

This article is the first of a series in which it is proposed to consider all aspects of cherry growing under Victoria conditions. Twenty-six of the varieties commonly grown in Victoria are individually described, the most popular being Bedford Prolific. There is a short discussion on the most suitable soils and locations for the orchard. The remainder of the article deals with rootstocks and seed raising. Three stocks are in use in Victoria, viz. *Prunus Avium* (Mazzard), *Prunus Cerasus* (Kentish), and *Prunus Mahaleb* (Mahaleb). These are described. Mazzard is the stock mostly used and is generally imported from France as seedlings, arriving in the summer (January). Methods of layering are described, which if generally adopted would enable the importation of seedlings to be discontinued. Trees on Mazzard are considerably larger and more productive than on other stocks and, though they take longer to come into bearing, have a longer life. They are more resistant to gummosis and black aphis than Kentish stock. Kentish stock has been used for many years. It is unsatisfactory on poor soils and induces a tendency to overcrop in some varieties. It is shorter lived and more subject to disease than Mazzard. The scion invariably overgrows the stock, starting to do so when the tree is three years old or less. The stock has a distinctly dwarfing effect. The stocks are usually raised from suckers, although this results in a one-sided and shallow root system and an ill balanced tree. To this is attributed the fact that many trees on Kentish stock incline at an angle of 10°-15°. The stock can also be raised from cuttings and root pieces. Better results are always obtained with this stock if the scions are grafted on the root as a root graft, or, if this is not practicable,

* Beale, W. J., *Bot. Gaz.*, 1905, 40 : 140-3.

† Duvel, *U.S. Dept. Agr. Bur. Plant Indus. bull.* 58, 1904, and *bull.* 83, 1905.

then as near to the roots as possible. Mahaleb is little used in Victoria. It comes into bearing earlier than Mazzard, withstands heat and cold better and will stand more pruning than either Mazzard or Kentish and it is very resistant to gummosis. Trees on it live longer than those on Kentish stock but not so long as those on Mazzard. It has a dwarfing effect and the union between stock and scion is not always good. The stock usually outgrows the scion, the reverse of the case with Kentish. The stocks are imported as seedlings from France, but can be raised from cuttings and layers. Instructions are given for raising seedlings both of stocks and of scion varieties, emphasis being laid on the need for careful stratification, since improper storage of seeds is the main cause of failure. Imported seed is very unsatisfactory.

443. COE, F. M. 634.21 + 634.23

Chinese apricot and Black Orb cherry identified as old varieties.

Better Fruit, 1933, **27** : 12 : 6.

The Chinese and Jones apricots of Utah, U.S.A., locally renowned for their frost resisting qualities and excellent appearance, have been proved to be identical with Large Early Montagamet. The Black Orb cherry of Utah has been identified by Hedrick and others as Schmidt Bigarreau.

444. SHAMEL, A. D., AND OTHERS. 634.22 : 575.252

Bud variation in the Agen prune.

J. Heredity, 1933, **24** : 289-92.

Among variations noted and proved* by progeny tests to be bud variations are the following :— (1) A limb variation on a large secondary branch of a particular tree showing fruits nearly double the normal size. Progeny tests showed that the variation persisted. It is known commercially as the Coates strain ; (2) A non-productive limb variation, the non-productiveness persisting in the progeny ; (3) A late ripening variation, perpetuated by vegetative propagation. The writers consider that bud variation may be responsible for the presence in established orchards of low-yielding trees, propagated unwittingly from unproductive limbs. The first instance quoted shows that it may also be possible by observation to detect bud variations, the perpetuation of which may be profitable.

Propagation.†

445. UPSHALL, W. H. 634.23-1.541.5

Some experiments in budding fruit tree stocks.

Proc. Amer. Soc. Hort. Sci., 1932, **29** : 361-4.

The results of 4 years' work with Mahaleb and 3 years' work with Mazzard are now available. Each year 30 seedlings of each stock were budded at 10 day intervals from early June to mid-September. In each stock a plate bud and a shield bud were inserted, one on the west, the other on the north side. The growth made on the Mazzard stocks was in no case so satisfactory as that on the Mahaleb. The plate did not give better results than the shield buds except those done during the later part of the budding season. Shield buds could be used successfully on Mahalebs any time during August or September, but on Mazzards the optimum time was apparently mid-August. Spray injury from 3-6-40 bordeaux and 1-40 lime sulphur greatly affected percentage of " takes ". Rubber ties were found more satisfactory than raffia. Experiments were also made on methods of packing bud sticks. It is concluded that for shipments likely to be on the way more than 10 days the waxing method is the most satisfactory. In this the sticks are dipped into parawax at about 190° F. and withdrawn as quickly as possible. Of other treatments tried the order of decreasing value seems to be " oiled paper ", " moist moss ", " wet paper ", " wet moss ".

* See Casella's opinion, 536, 541.

† See also 526.

446. TANAKA, Y. 634.1/2-1.541.11
Some investigations on the grafting with fruit trees. [Japanese—English summary stencilled.]
Communications Hort. Institute, Taihoku Imp. Univ. No. **23**, 1932, pp. 40-55, bibl. 9, being reprinted from *J. Okitsu Hort. Soc.*, 1932, No. **28**.
The investigations were carried out at the Imperial Horticultural Exp. Sta., Okitsu, Japan. It was found that readiness to unite with the stock, but not the later growth of the graft, was in some degree influenced by the previous position of the scion on the tree, but that the results obtained varied with the variety. Further details on this point are not given in the summary. The length of the scion in veneer grafting also affects readiness of union, but the degree of influence again varies with variety and also with environment. Better union and growth was secured with the longer rootstocks. In pears equally good and rapid union was secured when the scion was worked on to the root itself as when worked on the root crown. The relative position of the terminal bud of the graft to the vertical cut on the rootstock had no appreciable effect on the future development of the graft.

Rootstocks.

447. TYDEMAN, H. M. 634.11-1.523
Breeding experiments with " paradise " apple rootstocks.
J. Pom. Hort. Sci., 1933, **11** : 214-36, bibl. 21.
An account of observations on the growth and on the botanical characters exhibited by a large number of seedlings raised by crossing Malling No. IX (Jaune de Metz) stock with Malling I, II, IV, V, VI, VII, XII, XIII, XV, and XVI. It was hoped to find that the seedlings from particular crosses would in general exhibit definite botanical characters, which might later be useful in determining whether chance stocks were likely to prove valuable or the reverse. Records of 15 botanical characters observed both on the young seedlings and on the shoots from the stools show that the segregation of these characters in the seedlings is variable and not discontinuous. The author notes that minute observations during three seasons on twenty-eight different shoot or root characters in nineteen families of seedlings failed to reveal a single case in which it could conscientiously be said that a greater or lesser amount of inter-grading between the classes did not occur. He considers that this lack of discontinuity is probably due to the polyploid constitution of the apple. Excellent illustrations of different types of leaf pose, and of the different sizes and conformations of root conclude the article.

448. TANAKA, Y. 634.13-1.541.11
Investigations on the value of oriental pear species as rootstocks for cultivated pear. [Japanese—English summary, 1 p.]
Communications Hort. Inst. Taihoku Imperial Univ., No. **26**, 1933, pp. 37-56, bibl. 23, being reprinted from *J. Okitsu Hort. Soc.*, 1933, No. **29**.
From 1923-6 investigations were carried out at Okitsu Experiment Station on the merits of several oriental pear species as rootstocks for cultivated pears in Japan. As scions European pears were represented by Bartlett and Japanese pears by Chojuro. When raised from seed *Pyrus serotina* provided the most suitable habit of growth for rootstock work, since *Pyrus calleryana* and *P. Fauriei* were too slender and *P. ussuriensis* too dwarf. The Chojuro pear was incompatible with *P. calleryana*, *P. Fauriei* and *P. umemurana*, but Bartlett agreed with them fairly well. *P. ussuriensis* can be regarded as of doubtful value for Bartlett, but Chojuro does well on it. Seedlings of *Pyrus betulaefolia* and *P. Bretschneideri* gave such good results with both the Chojuro and Bartlett that their value as rootstocks is to be further investigated. Meanwhile *P. serotina* remains the most suitable rootstock in Japan for all classes of pear. [This work in Japan is particularly interesting in view of Reimer's very complete study of oriental pear stocks under American conditions. *Oregon Agr. Coll. Exp. Sta. bull.* 214, 1925.—ED.]

Root Growth.

449. TANAKA, Y. 634.1/2-1.536
Investigations on the time of transplanting of young fruit trees. [Japanese—English summary.]
Communications from Hort. Institute Taihoku Imp. Univ., No. **31**, 1932, pp. 1155-65, bibl. 15, reprinted from *Agriculture and Horticulture*, 1933, Vol. 8, No. 5.
The paper reports the results of investigations of initial root growth in spring of certain fruit trees in Japan. The work was carried out at the Imperial Horticultural Experiment Station, Okitsu in 1927 and 1928. Stone fruits such as plums and peaches begin root growth in early February at a soil temperature of 4-5° C. Pears and apples begin in mid-Feb. at 7-8° C., grapes and figs late in March at 9-10° C., chestnut and *Diospyros Kaki* in mid-April at 12° C. Citrus is the last to start in mid-May when the soil temperature is between 16-18° C. Autumn transplanting is advised for plants starting root growth at temperatures up to 8° C., but those that start it later can be transplanted either in spring or autumn.

450. BECKENBACH, J., AND GOURLEY, J. H. 634.11-1.8 : 581.144.2
Some effects of different cultural methods upon root distribution of apple trees.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 202-4.
The position in which roots were found in orchards of Stayman Winesap, Grimes Golden and McIntosh suggests that fertilizer should be applied not only beneath the spread of the branches, but even over the entire surface of the orchard, where the trees are 12 or more years old. When under sod the orchard should receive these applications quite early to avoid absorption of the nitrogen by the grass roots.

451. OSKAMP, J. 634.1/2 : 581.144.2
The rooting habit of deciduous fruits on different soils.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 213-9, bibl. 1.
The rooting habit in various soil profiles of the following fruit varieties is described :—Baldwin apple, Montmorency cherry, Elberta peach, Bartlett pear, Italian prune. The data collected indicate relationship between certain soil profile characteristics, the yield and the stand of different kinds of fruit trees. There is probably a greater difference in depth of rooting between the same fruits on different soils than between different fruits on the same soil. It is recognized that other factors besides soil have an influence on the distribution and depth of rooting.

Growth, Nutrition, etc.

452. HARLEY, C., AND OTHERS. 634.11-1.8 : 581.45
Effects of leaf area, nitrate of soda, and soil moisture on fruit bud formation in the Delicious apple.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 193-8.
In these experiments the amount of soil moisture did not apparently affect fruit bud formation. The principal factor in the initiation of fruit buds in the apple appeared to be the ratio of the amount of foliage to fruit. Hand thinning practices which establish a relatively high leaf to fruit ratio early in the season should in the writers' opinion help considerably towards annual bearing.

453. DEGMAN, E. S., AND OTHERS. 634.11-1.432
Relations of soil moisture to fruit bud formation in apples.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 199-201.
Experiments at Hancock Md. indicate that during a dry season irrigation does not directly increase fruit bud formation on trees bearing a heavy crop. In seriously devitalized trees, however, which had previously suffered severely from drought and were not carrying any crop, irrigation tended to increase fruit bud formation.

454. OSERKOWSKY, J. 634.13-2.191 : 581.174
Quantitative relation between chlorophyll and iron in green and chlorotic pear leaves.
Plant Physiol., 1933, **8** : 449-68, bibl. 17.
Only part of the iron in leaves is found to be effective in chlorophyll formation. A method is described for estimating this *active* iron, the method being based on the assumption that the *active* iron or its derivative is contained in 1·0 N HCl extract of dried leaves.

455. HEINICKE, A. J. 634.11-1.542.24 : 581.192
The assimilation of carbon dioxide by apple leaves as affected by ringing the stem.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 225-9, bibl. 3.
The investigation was undertaken to determine to what extent photosynthetic activity was influenced by the practice of ringing. This information is needed to evaluate fully the results of experiments where ringing treatments are involved. The apparatus used in the experiment is described. It is shown that the ringing of a shoot results in reduction of the activity of the leaves above the ring to $\frac{1}{3}$ to $\frac{2}{3}$ of normal, a state which becomes manifest at the latest within 3 days. The healing of the ring leads to a recovery of activity. Often the leaf below the ring shows a reduction in photosynthetic activity, the reason for this not being clear to the author. In one case of a plant with very thin, light foliage, possibly representing a special condition, the activity of the leaves was increased by ringing. The effect of ringing individual leaves is the same as where the shoot is ringed. The low value for apparent assimilation is associated with an increase of respiration due possibly to the " harmful influence of an accumulation of the products of photosynthesis ; possibly also due to the lack of water and nutrients from the soil." From the data secured (presented here in tabular form) the author concludes that in studies on the relationship of leaf area to the development of fruit, involving the use of ringing, it may be necessary to discount the indicated values. Fewer leaves would quite possibly be needed on unringed branches for the development of the fruit than is indicated by results on ringed branches.

456. COLBY, H. L. 634.22-1.8 : 581.192
Effects of starvation in distribution of mineral nutrients in French prune trees grown in culture solutions.
Plant Physiol., 1933, **8** : 357-93, bibl. 8.
The effects were noted of starvation of Mg, Ca, K, N, P and S. Symptoms typical for each of the elements lacking were produced in the first year. Foliage symptoms were usually most strikingly characteristic and developed first except in the case of calcium starvation where root trouble was entirely dominant. Calcium starved trees rarely grew enough to show the leaf mottling characteristic of most calcium-low plants. Elemental starvation often produced changes in the mineral composition of leaf or bark tissues very different to those produced in the wood, root, etc. Results of introducing potassium, previously withheld, into the culture solution after 2 years are noted. As regards pH it was found that elemental starvation was more effective in altering the pH of leaf sap than were changes in the pH of the culture solution itself. [From author's summary.]

457. ANAGNOSTOPOULOS, P. TH., AND GALANOS, SP. 634.64 : 581.192
The influence of the chemical composition of some organs of the olive tree on the fruiting of it. [English—Greek summary.]
Praktika de l'Académie d'Athènes, 1933, **8** : 208-15, bibl. 7.
The authors analysed the leaves and twigs of olive trees, both the wild olive and the Attic olive, which were of three distinct types, viz. strong growing and poor fruiting, moderate growing and good fruiting, and poor growing and poor fruiting. The analyses are here tabulated, the authors coming to the following conclusions : 1. The presence of adequate nitrogen in conjunction with carbohydrates helps healthy vegetative growth but hinders fruiting. 2. Decreasing the

nitrogen, other conditions being the same, allows of moderate vegetative growth and good fruiting. 3. Where the carbohydrate nitrogen ratio is too high both growth and fruitfulness suffer. 4. When the last-named conditions prevailed, after fertilization of flowers and formation of fruits (on ringed branches), the fruits contained more oil than under condition 2.

458. Widdowson, E. M. 634.11 : 581.192
Chemical studies in the physiology of apples. XIII. The starch and hemicellulose content of developing apples.
Ann. Bot. 1932, **46** : 597-631, bibl. 56.

A method has been developed for the determination of starch in apple tissue. After a preliminary extraction of the alcohol-insoluble apple residue with cold potassium oxalate solution to remove some of the pectin, the starch is hydrolysed by means of taka-diastase, and the glucose and maltose in the hydrolysis mixture are estimated by oxidation with alkaline ferricyanide and alkaline iodine.

Determinations of starch have been carried out on alcohol-insoluble material obtained from samples of Bramley's Seedling and Worcester Pearmain apples. Samples were collected at intervals of a few days, starting with the flowers immediately after the fall of the petals. The changes were followed up to the stage of the mature fruit, and later in storage. Starch begins to appear in the middle of June, rises to a maximum concentration of 1·5-2 per cent. of the fresh weight at the end of July in the Worcester Pearmain and at the end of August in the Bramley's Seedling, then falls again, disappearing completely at the end of October in both varieties of apple.

Estimations of pectin were carried out on the same samples by extracting the tissue with N/75 HCl. The acid was found to remove much more material from the residue than could be accounted for by starch and pectin, and it is concluded that apple tissue contains some readily hydrolysable polysaccharide other than starch or pectin.

Two water-soluble substances have been isolated from apple residue which are not hydrolysed by taka-diastase nor precipitated by calcium chloride. One is shown to be a polyuronide and the other to be a polysaccharide. Both yield arabinose on hydrolysis and belong to the class of substances known as hemicelluloses.

Both hemicelluloses and pectin in the developing apple increase steadily to a constant value which does not fall to any extent during storage. This observation, together with a consideration of the hydrolysis products of the hemicelluloses, suggests that they do not serve as a reserve carbohydrate supply for the fruit, but that in structure and function they are intimately related to pectin. [Author's summary.]

459. Riehs, E. 634.1/2 : 581.11.
Saugkraftuntersuchungen an Obstgehölzen. (**Suction pressure in fruit trees.**)
Gartenbauwissenschaft, 1933, **7** : 629-38, bibl. 8.

The author gives suction pressure maxima and wilting points determined by him for a large number of fruit and nut trees and deduces that the success of rootstocks, the value of fruit produced, drought resistance, etc., bear some relation to these figures. In dealing with rootstocks he presents figures for such stocks as Myrobolan and St. Julien, but gives no indication that both these terms comprise a multitude of entirely different individuals.

460. Heinicke, A. J. 577.158.7
Apparatus for making autographic records of catalase activity of plant tissues and the procedure involved.
J. Agr. Res., 1933, **46** : 1137-43, bibl. 8.

The writer notes that catalase activity of the leaves or of the bark affords a convenient and highly sensitive index to certain changes in the internal condition of the plant, which in turn

may be related to vigour of shoot growth, flower bud formation, etc. There has been no standard method hitherto and results obtained have depended on methods used. The apparatus described and illustrated here is an elaboration of the device described by the same author some years ago (*N. York (Cornell) Agr. Exp. Sta. mem.*, 74, 1924). Its chief features are that it enables the simultaneous determination of catalase activity in 12 different samples of tissue with an autographic record of the results in each case. After giving details of its working the writer discusses a graphic record of apple catalase activity. It is obvious in this case that the growing points are more active than leaf tissue and that the bark is less active than either. The activity for a given time varies moreover with the tree.

461. DASTUR, R. H., AND SAMANT, K. M. 581.192 : 581.45
A method for the determination of carbohydrates in leaves.
Indian J. Agr. Sci., 1933, 3 : 460-77, bibl. 51.

The method of Folin and Wu (1918), subsequently improved upon by Calvert (1923-4) for estimating sugars in blood is here modified for estimating carbohydrates in leaves. The authors claim to have removed various sources of errors and to have added various improvements which they describe.

462. ARCHBOLD, H. K. 634.11-1.55 : 581.192
Chemical studies in the physiology of apples. XII. Ripening processes in the apple and the relation of time of gathering to the chemical changes in cold storage.
Ann. Bot., 1932, 46 : 407-59, bibl. 67.

Analyses were carried out during the 2 seasons of 1929 and 1930 on unmanured Bramley's Seedling and Worcester Pearmain apples growing in grassed-down orchards. The trees were standards and about 20 years old. The samples comprised 2 fruits from each of 13 trees in 1929 and 14 trees in 1930 of Bramley's Seedling, and 2 fruits from each of 10 trees in 1929 and 11 trees in 1930 of Worcester Pearmains. The method of determination of sugars which has been considerably modified is described in full. The following, among others, are points made by the author in her summary. Total growth rate, i.e. mean increase in weight per apple, was found to increase for the first three weeks of growth and then to remain constant until picking. In the first three weeks of growth 15% of the solids were stored as sugar, glucose being slightly in excess of fructose and sucrose. Starch synthesis began after 22 days and lasted about 60 days in Worcester Pearmain and 30 in Bramley's Seedling. During this time the percentage of solids stored as sugars increased to 55, of which 25-33 was fructose ; the solids stored as acid and insoluble material dropped to about 17%. In the final stages of ripening over 80% of the solids were stored as sugar and only 14% as acid and insoluble material. Bramleys are generally gathered when containing only a little starch, but Worcesters may contain up to 1%. If only a little starch is present at gathering, the initial rate of loss of dry weight is very low and increases only slowly at first. During starch hydrolysis sugar content rises, reaching a maximum just before starch disappears. About this time sucrose begins to decline and total sugar falls slowly. The increasing rate of sugar consumption is associated with an increasing proportion of fructose in the sugar lost. Glucose remains constant or increases slightly during storage. Acid is lost continuously and also some alcohol-insoluble material. Only part of the hydrolysis products of the insoluble material is oxidized, the rest appearing to accumulate as a soluble non-reducing substance, which was not determined. Late gathering is associated with a low average rate of total sugar loss, a high rate of sucrose inversion and a high level of concentration at which sucrose inversion nearly ceases. The changes in reducing sugar are also greater in late-picked fruit and the initial acid concentration is low. The fact that no internal breakdown occurred in any of the pickings indicates that changes in the nature of the carbohydrate oxidized are not a principal factor in determining susceptibility to this disease.

Pollination.

463. BRITTAIN, W. H., AND OTHERS. 634.11 : 581.162.3

Apple pollination studies in the Annapolis Valley.

Dom. Canada Dept. Agr. bull. **162** (N.S.), 1933, pp. 198, bibl. 100.

The investigations described in this bulletin grew out of a request of the Department of Agriculture of Nova Scotia and of various horticultural organizations that a study be undertaken to determine whether the alleged destruction of pollinating insects by poison dusts and sprays was adversely affecting the set of fruit in commercial apple orchards. The bulletin consists of six sections written by the various workers under the general direction of W. H. Brittain. In the earlier part a very comprehensive review is given of the fruit growing industry in Nova Scotia and a further section is devoted to a thorough review of the principles underlying the various forms of sterility in fruit trees. In a series of careful studies of the inter-fruitfulness of apple varieties dealing with the varieties Gravenstein, King, Golden Russet, Baldwin, Cox's Orange and Northern Spy, the writers deal with the conditions of pollen tube growth, tent studies in which cages were erected over trees of the varieties Gravenstein, King, Spy and Baldwin, effective pollinizers and bees being included in certain cases and excluded in others, and hand-pollination studies by the limb unit method. The exclusion of pollinating insects reduced the crop produced to an unprofitable level in all cases. The use of an effective pollinizer gave a higher percentage of fruit than where ineffective pollinizers were used. The introduction of an effective pollinizer in Baldwin, Gravenstein, King and Spy has given an increase in yields over selfed trees. In the case of Baldwin a good commercial crop could be obtained by selfing. Gravenstein and Spy were self unfruitful but King was quite self fruitful. In a section on planning the orchard the writers give comparative dates of blossoming for a large number of varieties and state that the planting of blocks of self unfruitful varieties should be avoided, a proper admixture of cross fruitful varieties being desirable. Careful descriptions are given of the insects concerned in the pollination of fruit trees and by the provision of observation stations data were obtained of the relative abundance of the various insects during different times of the year and in relation to differing climatic conditions. It was found that the most important agents at the present time were various species of solitary bees. Observations made indicated that in the average orchard the number of solitary bees present during bloom was about equal to the force of hive bees that would be released from one strong colony per acre. With little other bloom available one-third of the total field force of hive bees may be found at one time in the apple blossom. Of these not all were of equal value in pollination since a large proportion were nectar gatherers. Solitary bees visited the blossoms mainly for the purpose of collecting pollen. Hive and wild bees reacted similarly to temperature, light, wind, humidity, etc., but hive bees appeared to work longer hours and, while optimum temperature for both is about the same, a larger proportion of hive bees were found at the lower temperature ranges and lower light intensities. Furthermore, the fact that hive bees will work actively near the hive during brief bursts of favourable weather gives an advantage to orchards so supplied in years of uncertain and changeable weather during bloom. In pollen gathering habits the solitary bees were equally well adapted for pollination purposes, and, in some respects, appeared to have an advantage. In certain seasons in some localities at least adequate pollination is effected by native solitary bees. Where this condition does not obtain the provision of a suitable number of colonies should be practised as part of the regular orchard routine. Even the most fruitful varieties require bees in order to ensure adequate pollination. The point is particularly emphasized that in estimating the number of colonies per acre of orchard, the surrounding district and not the individual orchard should be considered the unit. It is best to place the bees in the orchards when the earliest varieties are in full bloom and remove them before the petals have fallen from the later varieties. The proper distribution of cross fruitful varieties in an orchard is a primary requisite to successful pollination. In summarizing their studies of bee poisoning the writers state that the question of poisoning of bees from poisoned sprays and dusts used in orchards is obviously important from the standpoint of their utilization for pollination purposes. A survey showed that the hive bee population had been greatly depleted during recent years, and the evidence pointed clearly

to the conclusion that this had been directly due to the use of poison sprays and dusts. Under orchard conditions it appeared that arsenic in the form of lead or calcium arsenate was the main source of bee poisoning in the mixtures used, but even sulphur dust alone might cause trouble. Arsenical poisoning resulted in partial to complete paralysis and was first evident by " crawlers " appearing in front of the hive. When the internal arsenic in bees was greater than ·00004 mg. of metallic arsenic per bee poisoning might be expected, definitely so when higher than ·00008 mg. was detected. All sprays containing an arsenical as an ingredient were dangerous when applied during bloom. Only sprays or dusts containing arsenicals resulted in dead brood. The combination causing the most sudden and complete mortality was sulphur-lead arsenate in dust form. In general, less mortality resulted from sprays and dusts containing copper or nicotine as an ingredient along with the arsenical. Observations indicated that the greatest poisoning usually occurred just previous to and just after the main bloom, but no time during the season from May until August was completely safe. Weather conditions had an important bearing on the incidence of poisoning among bees. Very severe poisoning was noted even when prevailing conditions were cool and wet, and some of the worst cases took place following brief bursts of fine weather intervening between periods of broken weather. The main source of poisoning of bees and brood was evidently pollen, but, under certain conditions, drop water from sprayed leaves, petals or herbage growing in the orchard may be a very important factor. Least trouble was experienced when bees were not placed in the orchards until the early varieties were in bloom after the application of the "pink" spray and were taken away before the beginning of the "calyx" spray. Samples of pollen taken from the nests of solitary bees showed ponderable amounts of arsenic, more than enough to destroy the larvae of hive bees. Evidence of depletion of the solitary bee population from this cause was difficult to secure. H.M.T.

464. Rawes, A. N. 634.13 : 581.162.3
Pollination in orchards. IX.
Contributions from the Wisley Laboratory, LXVIII from *J. Roy. Hort. Soc.*, 1933, **58** : 288-95, bibl. 2.

A summary of the results of investigations at Wisley on the pollination of pears. Over 120 varieties of pears and 40,000 flowers have been dealt with in the course of these investigations which have extended over a period of 10 years. The average number of days separating the full flowering of the earliest and latest varieties is eighteen and the average period over which a variety remains in flower is the same. Twenty varieties were regarded as self-fertile, i.e. they set more than 4% when artificially self-pollinated. Thirteen varieties are partly self-fertile having set more than 1% but less than 4%. Twenty-one varieties set an occasional fruit when self-pollinated. Forty-two varieties were completely self-sterile. No case of cross incompatibility was observed, so that, as long as varieties flowering at approximately the same time are planted together, effective pollination should be assured. Trees considered self-fertile nevertheless set a higher percentage of fruit when cross pollinated. Classified lists of the order of flowering are given.

465. Phillips, E. F. 634.11 : 581.162.3
Insects collected on apple blossoms in Western New York.
J. Agr. Res., 1933, **46** : 851-62, bibl. 4.

The writer's observations showed the comparative scarcity of insect life in the typical fruit area investigated. The most abundant wild insects visiting blossoms were flies and solitary bees. Lists are given of these, together with notes as to temperatures obtaining, time of observations, etc. It is not considered that fruit-growers can do much of practical value towards raising the insect population.

466. Murneek, A. E. 634.11-2.8 : 581.162.3
The nature of shedding of immature apples.
Missouri Univ. Agr. Exp. Sta. research bull., **201**, 1933, pp. 34, bibl. 20.

The results of a four years' study of the shedding of non-setting flowers and immature fruits by trees of known pollination. The varieties were Delicious, Stayman, Winesap, Rome, Grimes,

Jonathan, Ben Davis. They each exhibit both in on and off years four waves of abscission occurring at approximately 12-14 days' interval, the first drop being of a compound character since it probably includes many unpollinated flowers. The three succeeding drops are made up of fruits of various but quite definite sizes, the immediate and most important cause being probably embryo abortion. Delicious and those of the Winesap group show a characteristic and pronounced early abscission of flowers and fruits, while Duchess and Wealthy are noticeable for their later drops. Self-pollination leads to a heavy first drop, the succeeding ones being correspondingly lighter. Cross pollination increases the second and third drops and may affect the fourth. The variety of pollen appeared to have no characteristic influence on the nature of the shedding of apples. A high yield of fruit may be obtained even when the last two drops are heavy. The probable causes of first wave abscission may be (a) structurally and functionally abnormal flowers, (b) unpollinated or unfertilized flowers, (c) early aborting embryos. The second drop is probably due to physiological causes created by the excessive competition among the young apples. The third and fourth drops are also probably due to the food supply, particularly nitrogenous, but it has yet to be shown that the wave-like character of the fruit sheddings can be altered thereby. Environmental factors indeed have but little if any control over this periodicity, which is evidently connected with the seasonal development of the tree. Or possibly this periodicity of fruit shedding is connected with stages in the development of the apple itself, since the fruit is a more or less independent organ with its own structural development.

467. BRANSCHEIDT, P. 634.25 : 581.162.3
Beitrag zur Frage der Sortenbeschreibung und der Fertilitätsverhältnisse beim Pfirsich. (**Differentiation of varieties and fertility in the peach.**)
Gartenbauwissenschaft, 1933, **8** : 45-76, bibl. 21.

The first descriptive feature used is the shape and size of blossom, the colour in general, though not always, decreasing with increasing size of blossom. The writer differentiates the flowers as follows :—rose-shaped large and small, bell-shaped large and small, and finds this sufficient. Another distinguishing mark is relative date of flowering. Further the shape of the petals is important, ranging from more or less circular to egg-shaped. The relation between the size of petals and sepals was found to vary from 4 : 1 in Pfalzperl to 1·5 : 1 in small, bell-shaped flowers. In some varieties the anthers are enclosed in the petals until the flower is mature, and in these cases pollination takes place prior to the opening of the flowers. Neither the set of the anthers nor multiplicity of styles is a reliable distinguishing mark. Another phenomenon of doubtful distinguishing value is the possession of different types and sizes of leaf glands. The form of growth of the tree is also not entirely reliable. It is thought, however, that some or all of the above may form a valuable basis for genetic work on peaches. The writer also describes pollen germination studies with a large number of varieties. Of 27 varieties only J. H. Hale and June Elberta were found to have sterile pollen. The variety J. H. Hale would appear, however, not to be genetically true, as would seem also to be the case with several other varieties. The behaviour and size of the pollen tubes in different varieties are touched on. No relation was found between pollen germination capacity and time of flower opening, a fact which confirms Kobel's work, as also the decreasing germination capacity of pollen, the nearer one approaches the end of the shoot. The results of some 10,375 crossings and 8,413 selfings are tabulated. The only cases of self-sterility occurred also in J. H. Hale and June Elberta, all other varieties being entirely self-fertile. As in cherries pollen is found to be wind borne from tree to tree, the fertility of the two self-sterile varieties named above under very poor conditions for pollination by insects indicating this.

468. VON VEH, R. 634.2 : 581.162.3
Ueber die Fruchtbarkeit beim Kernobst. (**Fruitfulness in pome fruits.**)
Züchter, 1933, **5** : 199-208, bibl. 16.

The author describes the different forms of fruitfulness found among the higher plants as follows :—I. *Amphimictic*, where pollination and fertilization both occur. II. *Apomictic*

(with or without pollination ; in cases of induced apomixis partial fertilization occurs, but the genotype of only one parent is carried). *Apomictic* fruitfulness may be (1) *Parthenocarpic apomixis*, in which a sporophyte does not develop. (2) *Parthenogenetic apomixis*, where (a) the egg develops into a sporophyte without any reduction in chromosome number=*somatic* or *diploid* parthenogenesis, (b) the egg develops into a sporophyte with a reduced number of chromosomes= generative or haploid parthenogenesis. (3) *Apogamic apomixis*, (a) an unreduced vegetative cell of the gametophyte develops into a sporophyte=*somatic apogamy*, (b) a reduced vegetative cell of the gametophyte develops into a sporophyte. (4) *Vegetative apomixis*. A somatic cell lying outside the embryosac develops into a sporophyte within the embryo sac. (5) *Pseudogamic apomixis*. The egg cell after successful stimulation develops into a sporophyte carrying the genotype of only one parent. The writer considers that one of the most important factors in determining fertility or sterility is the presence or absence of a definite tendency to fertility. Thus when no further development occurs after definite fertilization of ovules in an apple, the apple can be said to be lacking in this tendency. A further factor is the tendency to set fruit. A list is given of some 130 apple and 80 pear varieties grown in Germany, differentiated according to the way in which they carry their fruits, i.e. (1) in bunches, 4-6 fruits in a bunch, some of the fruits not being well shaped, or (2) in pairs, or (3) separately, the individual fruits being generally well formed. In group 3 for instance is Belle de Boskoop. In this variety all the flowers may be duly pollinated but only rarely will any but the terminal ones set fruit, because the non-terminal flowers do not possess this tendency to fruit formation. It is interesting to note that differences in method of carrying their fruits are quite independent of chromosome complements. It is concluded that to pollinate thousands of blossoms without previously determining the tendency to fruit formation in the variety concerned is a waste of energy, time and material. The author refers to an article by himself in which it is shown that the necessary determination can be made by exact experimental analysis. (*Züchter*, 1933, 5 : 4 : 77-85.)

Manuring, Cultural Practice.

469. FAGAN, F. N., AND OTHERS. 634.11-1.8

Twenty-five years of orchard soil fertility experiments.

Pennsylvania Sta. Coll. Agr. Exp. Sta. bull. **294**, 1933, pp. 19.

In 1908 one-year-old Northern Spy trees were planted and in the following year were topworked with Yorks, Staymans and Baldwins. The general layout, projects and purpose are briefly outlined and the more notable results detailed. In each major project some 200 trees acted as experimental material. Randomization was not adopted. From this quarter-century of research the authors draw certain conclusions which include the following :—(1) Fertilizers are only part of the problem of soil fertility. This involves the nature of the soil, its depth and topography, previous treatment, the use of fertilizers and manures, cultivations and covers or sods grown. (2) Where in this orchard a treatment has influenced trees, it has done so in the following order :—first cover crops ; next, perhaps several years later, leaf colour ; shortly afterwards branch growth and girth increase ; and lastly yield. (3) The reason for this sequence is that all treatments have influenced yields chiefly by changing the organic matter content of the soil. (4) Treatments which have built up the organic content have kept the soil in condition to absorb and not lose moisture. (5) Slope, though only slight to the eye, has created differences in growth and yield nearly as great as those induced by any treatment given. Good treatments have only nearly offset initial disadvantages of poor soil. (6) A short, non-legume sod rotation is an efficient means of building up a depleted orchard soil. It should be turned or partially broken often, otherwise tree growth will be checked. (7) Moisture conditions are more favourable in the sod than in the cultivated orchard. (8) Under a non-legume sod soil nitrates have become very low in early summer, necessitating early application of nitrogenous fertilizers. (9) To maintain equal yields Stayman and Baldwin must make longer branch growth than York.

470. COLLISON, R. C., AND HARLAN, J. D. 634.11-1.4
Some facts about soil management in a New York orchard.
N. York Agr. Exp. Sta. Geneva, bull. **629**, 1933, pp. 20.
An account of the health of a bearing orchard of mixed varieties which received no commercial fertilizer but was subjected, especially when young, to consistent soil management. The regular use of red clover seeded every two years resulted in the establishment of an important humus and nitrogen reserve in the soil, this being reflected in regular and fairly uniform bearing. The trees previously treated thus with red clover were in 1927 divided into plots, and, while one still received the old red clover treatment, other treatments given were permanent seedings of (1) red clover, (2) lucerne, (3) grass sod, (4) sweet clover. In 1929 the red clover and the grass sod were excellent, the lucerne was only fair and the sweet clover needed re-seeding. Nitrates were found abundantly in all plots, even in the grass sod plot, where, however, they were less than elsewhere. The superabundance of nitrates in the cultivated red clover plot suggests that cover crops might well succeed it in order to absorb the surplus nitrogen. No evidence was seen in any of the plots of the trees suffering from moisture deficiency. Observations made in these experiments indicate that the time to build up a reserve of humus and nitrogen is when the trees are young. The optimum of available nitrogen may be present in a soil even under grass sod receiving no commercial nitrogen, if this has previously been done and the soil is built up to a high level of organic matter. It is noted, however, that this level is probably of short duration and depends on conditions in any particular orchard.

471. COLLISON, R. C. 634.1/2-1.874
Relation between orchard soils and cover crops.
N. York Agr. Exp. Sta. Geneva, bull. **632**, 1933, pp. 18.
In the cultivated orchard provision is necessary sooner or later for the maintenance of organic matter. This may be made by growing cover or green manure crops. The sod-fertilizer system and the cultivation-cover crop system of management are discussed and compared. Notes are given on the use and value of legumes and the value of alternating them with non-legumes in a cover crop rotation system. As regards water competition the belief that a sod, whether legume or not, is likely to compete seriously with trees for moisture is found to be exaggerated. Much loss of nitrogen occurs when lucerne or other legume is ploughed in and not followed promptly by another crop. It is suggested that it should be followed at once by a non-leguminous cover crop.

472. READ, E. M. 634.1/2-1.8
Manuring the orchard.
J. Dept. Agr. Victoria (Australia), 1933, **31** : 377-80.
The effects of various fertilizers are explained. The different requirements of the soils in the various orchard districts of the State are discussed and suggestions are made as to the most suitable fertilizers to use for various conditions and localities.

473. PROEBSTING, E. L. 631.83 : 631.42
Absorption of potassium by plants as affected by decreased exchangeable potassium in the soil.
J. Pom. Hort. Sci., 1933, **11** : 199-204, bibl. 4.
Samples of the top 3 inches of two soils were taken for pot experiments. One was from a plot on which apples were making good growth and showing no sign of potassium starvation, the other was from a plot where apples were showing marked signs of potassium deficiency. The samples were then thoroughly shaken up with rain water, after which the coarser particles were allowed to settle and the supernatant colloidal suspension removed by siphoning. After repeating the process both samples were found to have suffered great reduction in their exchangeable potassium content. The experiment consisted in growing buckwheat in the following series of each soil :—untreated soil, treated soil without additions, treated soil + Wallace's complete nutrient solution less potassium, treated soil + Wallace's complete nutrient

solution. The effects on growth were carefully observed on harvesting the plants 3 months later and are here tabulated. A second experiment was made in the same soil with tomatoes, after which all soils were again tested for exchangeable potassium. The writer summarizes thus :— Data are presented which show that different plants vary widely in their ability to withdraw supplies of potassium from a given soil ; that neither exchangeable nor water soluble potassium is an accurate index of the soil's ability to supply potassium, and that the non-exchangeable potassium may be a very important source of supply to some plants in certain soils.

474. Proebsting, E. L. 631.4 : 631.8
Changes in concentration of certain constituents of the soil solution under orchard conditions.
Proc. Xth Int. Hort. Congr., Paris, 1932, Société nationale d'horticulture de France, rue de Grenelle 84, Paris 7e, pp. 179-81.

This work was done in connection with a study of the effect of cover crops and green manuring on the maintenance of deciduous orchard fertility at Davis, Calif. The treatments consisted of clean cultivated controls, lucerne sod, summer cover crops of *Phaseolus aconitifolius* (later replaced by *Dolichos Lablab*) and winter cover crops of *Melilotus indica* and of rye grown across the different kinds of fruit trees. Samples of soil were taken and the soil solution was determined by the displacement method. Results of examination of samples taken at different times and at different depths are here summarized.

475. Overley, F. L., and others. 634.1/2-1.67
Irrigation of orchards by sprinkling.
Washington Sta. Coll. Agr. Exp. Sta. bull. **268**, 1932, pp. 50, bibl. 6.

This is an exhaustive account of various features of overhead irrigation, reasons for using one or other system of sprinkling, probable effects on pests and diseases—if any—and influence on tree growth. The types investigated included gear-driven, reaction and stationary head sprinklers, of which the operating characteristics are discussed. The reaction type is found to be the most efficient. In this type water is forced out through nozzles just as in the motor driven sprinklers. The sprinkler head is equipped with 2 or more nozzles, but instead of a water motor and set of gears, the dynamic action of the water as it leaves the nozzle and passes through the air builds up a back pressure which reacts upon the nozzle, constantly pushing it backwards, thus causing rotation of the sprinkler head. As regards the spread of disease the authors conclude : " Since conditions appear to be favourable for the development of certain diseases by the use of overhead sprinklers, it is possible that their continued use over a period of years might produce serious conditions." Further, they consider that the use of sprinklers seemed most likely to be economically successful on light, sandy, hillside soils where the natural head of water was sufficient to avoid use of booster pumps.

476. Flintoff, A. 634.1/2-1.556.1
The support of fruit trees in heavy cropping seasons.
J. Dept. Agr. Western Australia, 1933, **10** : 213-17.

The following methods are discussed with advantages and disadvantages noted. (1) *Propping with forked sticks.* Cheap if material and labour are available, and keeps the branches in a normal position. Expensive if material not to hand ; inconvenient in carting and cultivating ; extra work in removing and stacking props ; frequent renewal of props ; damage to trees by falling props in windy weather. (2) *Cross-trees.* A system of tying limbs to one another by rope or wire through the tree or sometimes by a central ring with radiating wires. Cheap, permanent and easily fixed. Unbalanced trees with stronger growth on one side are liable to break their weaker limbs by the pull exercised by the heavily laden stronger branches of more developed size. The wires require padding at the point of attachment, and may also slow down spraying or pruning operations. (3) *Girdling.* Ropes or wires encircle the branch system at one, two or three distances above ground as necessary. Subleaders may be tied to any part of the wire. Liable to cut or chafe branches at points of contact. Risk of damage if the strong

side of the tree drags the weak side over. Not a satisfactory support in low spreading trees. (4) *Maypole.* A stout pole 8-10 ft. long, 3-4 inches in diameter at the top, is tied, one end resting on the ground either erect or slanting, to the tree trunk. From the top of the pole wires radiate and are attached to the limbs at suitable points by hooks. This method combines permanency with efficiency; there is no obstruction to orchard traffic. In spraying and pruning the wire can be unhooked from the branches and hang down the pole out of the way. An unbalanced tree cannot collapse since the pole takes the strain. There is a higher initial cost, the arrangement is considered unsightly to many, the pole may harbour insect pests. This system, however, fairly new to Western Australia, is the one recommended by the author, and the article ends with a very full description of the best way of making and erecting the support.

SMALL FRUITS, VINES, NUTS.

477. Darrow, G. M., and Waldo, G. F. 634.713-1.523
Pseudogamy in blackberry crosses.
J. Heredity, 1933, **24**: 313-5, bibl. 8.

Two European varieties are of commercial importance in the U.S.A., namely the Oregon Evergreen (*R. laciniatus*) and the Himalaya (*R. procerus*). Schuster found that, as regards the former, unpollinated, emasculated flowers produced no seed, while pollinated flowers regularly set seed and reproduced the female parent exactly. This is said to agree with Lidforss and Gustafsson's work in Europe. Some years ago also Darrow raised several hundred seedlings of Oregon Evergreen, Himalaya and Edward Langley, all European varieties. All the seedlings were apparently pseudogamic. But when flowers of the Oregon Evergreen were emasculated and pollinated with Himalaya, 2 true crosses out of about 10 seedlings were obtained. Further in 1932 Darrow and Waldo crossed Oregon Evergreen and Himalaya with (pollen of) various American varieties. Results indicated that about 1/10 of the Oregon Evergreen crosses and about 1/3 of the Himalaya crosses may be expected to be true seedlings and 9/10 and 2/3 to be pseudogamic seedlings respectively. In the cross Himalaya × Eureka 8 out of the 10 were true crosses. The numbers are too small to be significant, but the result recalls at least Lidforss' suggestion that, if the parents are closely related, true and false hybrids occur in about equal numbers. Results of crossing Oregon Evergreen × Himalaya and Himalaya × Austin Thornless are noted.

478. Wilhelm, A. F. 634.1/8-2.111
Experimentelle Untersuchungen über die Kälteresistenz von Reben u. Obstgehölzen. **(Investigations on cold resistance in vines and fruit trees.)**
Gartenbauwissenschaft, 1933, **8**: 77-114, bibl. 26.

Direct artificial freezing was applied to vine rootstocks, vine cuttings, fruit tree rootstocks and branches of apples and pears to determine their relative cold resistance. Further the influence on this resistance of the application of different mineral fertilizers was also tested. The following results are reported :—(1) The roots of European vines showed on the average less resistance than those of American varieties. Those of Müller Thurgau and Riesling were the most susceptible of all, other European varieties being slightly less so. Of the American stocks the roots of 143 B were the least resistant: Kober 5 BB and Ganzin I were slightly better: the greatest resistance of all was shown by 3309, and especially by 101^{14} and Riparia I Geisenheim. Weak growing specimens of 101^{14} stocks were less resistant than strong growing ones. (2) Of European cuttings Portugieser was slightly less susceptible than the extremely susceptible Müller Thurgau, while Riesling showed the greatest resistance. Of the American varieties 143 B was the most susceptible, and 3309, Riparia I Geisenheim and especially 101^{14} the most resistant. Kober 5 BB and Ganzin I showed greater resistance than 143 B. Old wood from weak growing stocks of 101^{14} was less resistant than that from strong growing stocks. (3) Both excess of nitrogen and deficiency of phosphorus resulted in the greatest root susceptibility, while generous applications of potash produced the greatest resistance in roots. Old wood from unmanured or potash

deficient stocks was less resistant to cold than that from properly manured stocks. (4) Apple rootstocks showed greater resistance than cherry, apricot, Brussels plum, quince and pear rootstocks, while of apple rootstocks crabs and Doucin were the most hardy. (5) Of apple varieties Grosser Rheinischer Bohnappel and Winter Goldparmäne were very susceptible, and at the other end came Apfel aus Cronsels, Weisser Klarapfel and Rheinischer Winter-Rambour. Williams pear was less resistant than Clapp's Favourite and Köstliche von Charneu. Comparisons of losses from cold in the winter 1928-29 with results obtained in these determinations show the accuracy of the latter.

479. MOOG, H. 634.83
Beiträge zur Ampelographie. III. (**A contribution to ampelography.**)
Gartenbauwissenschaft, 1933, **8** : 1-44, bibl. 12.

This is a continuation of the author's previous articles on the subject (*H.A.*, 1932, 2 : 3 : 266). He here details the characteristics and distinguishing features of the vines grown at Geisenheim and of the American varieties and hybrids thereof at Tiefenbach. Notes are given on the identity of certain varieties, and detailed descriptions provided for some 34 varieties including crosses of Madeleine Royale × Riparia, Riesling × Riparia, Riparia × Rupestris, Rupestris seedlings, etc.

480. CASELLA, D. 634.844.1-1.535
La propagazione della *Vitis Berlandieri* per talea. (**Propagation of the Berlandieri vine by cuttings.**)
Ann. R. Staz. Sper. Frutticoltura e di Agrumicoltura, 1933, **1** (N.S.) : 1-19.

The great difficulty with this otherwise admirable rootstock is to induce anything like a good percentage of cuttings to root. Here the author discusses and propounds theories to account for this phenomenon, describes his successful experiments and makes suggestions not only as to the best type of cuttings to use but also as to the best method of pruning and preparing the vines beforehand. Simple cuttings of the current season's wood did not readily produce roots, only some 19% being induced to do so. All other types, of which clear illustrations are given, contained some portion of 2nd year wood, and with them he got from 86 to 99% success. [The actual number of cuttings under trial is not stated.—ED.] He notes that cuttings so furnished with 2-year-old wood show great activity at their extremities but very little in the intermediate portions. This results in the rooted cuttings being vigorous from the outset and thus avoiding the reproach of slow development, which has previously been levelled against Berlandieri and its hybrids. Details are given of pruning methods to ensure a good supply of mature bud wood.

481. WOOD, M. N. 634.51 : 581.162.3
Dichogamy—an important factor affecting production in the Persian walnut.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 160-3, bibl. 5.
WOOD, M. N. 634.51 : 581.162.3
Artificial pollination as a means of increasing pollination in commercial Persian walnut orchards.
Ibidem, 1933, **29** : 164-8.

Dichogamy is found to vary with the age of the particular tree. Such variation is especially pronounced in some of the protandrous varieties. It also varies according to geographical location, and in general it is found that coastal regions emphasize a tendency to protogyny and decrease that to protandry. The ideal would be to plant a protogynous and a protandrous variety which bloom at the same time, but in California at any rate the two types are not generally suited to the same locality. Good pollinators are known for one or two varieties, but for others it is advisable to experiment before planting upon a large scale. In the second article the writer describes the success achieved by artificial pollination of Persian walnuts in California as a temporary measure in cases of failure of crop due to faulty pollination. Several methods are discussed, the most successful being as follows :—Catkins of all stages of development from a length of only half their size at maturity upwards were picked, put in bags of mosquito netting and suspended in the tops of the trees to be pollinated. The bags were jarred daily with large

poles. Good effects resulted in the orchards under trial. The essential points appear to be (1) to find enough catkin producing trees at a time when the pistils of the variety to be pollenized are receptive, (2) that the weather should be such as to induce the catkins to shed pollen and to allow the pollen to be wind borne by the stigmas, (3) that there should be enough labour ready at the crucial time to carry the process out.

482. BRISON, J. A. 634.521-1.541.5

The storage and seasoning of pecan bud wood.

Texas Agr. Exp. Sta. bull. **478**, 1933, pp. 26, bibl. 23.

Patch budding is now generally used for the vegetative propagation of pecans. Bud wood of the current season's growth can generally be used only from about mid-summer till the end of the budding season. For spring and early summer budding previous season's wood must be used. The practice of cutting this direct from the trees and using at once is only possible for a short period in early spring. The other method of using the previous season's wood is to cut scions 12" to 18" long from the trees during the dormant season and to store them, properly insulating against desiccation, at a temperature of 32° F. to 38° F. Experiments on the best method of seasoning or preparing this wood, so that the slipping of the bark may be easy at budding, show that a temperature of 80° F. to 85° F. is the best to facilitate this process. During seasoning experiments show that just sufficient moisture to prevent desiccation is ideal. It was found also that bud wood cut relatively late in the dormant season seasons more quickly than that cut early. The time necessary for the process varied in the two varieties tested, and was also shorter in late spring and early summer than in early spring after storing. It was found possible to keep bud wood in a viable condition for a period of about 3 weeks. The writer discusses his observations on the effect of disbudding on cambial activity, and notes the relation of cambial activity and of starch transformation to the seasoning process as shown in his work.

483. WOODROOF, J. G. 634.521 : 581.144.2

Relation of the root system of pecan trees to nursery and orchard practices.

Georgia Exp. Sta. bull. **176**, 1933, pp. 15.

The tap root of the pecan in its early stages grows downwards at the rate of ¼ to ½ inch per day to a depth of 2-3 feet. Further descent depends upon the obstacles encountered, such as hard pan or a high water table. Under the most suitable conditions a depth of 6 ft. is reached. The laterals begin to develop freely in the second year while the tap root growth slows down. The laterals are produced in an orderly rotation quite similar to that of the above ground branches, but they grow away from the trunk twice as fast and their spread is about twice the spread of the branches. Roots from adjacent trees planted 50 ft. apart will meet in ten years while the branches require 20 years to cover the same distance. In the third year the height of the tree, the depth of the tap root, and the radius of the root spread are about equal, while this year also sees the first formation of typical feeding roots. In the fourth year for the first time the height of the top exceeds the depth of the roots. In the fifth year root growth in depth ceases, but the growth of the tree continues in all other directions. At twenty years the volume of soil occupied by the roots is 1,400 cubic yards. In normally growing, cultivated trees the density of the roots in the soil is greatest under or just beyond the tips of the branches and at from 6-12 inches below the surface. The feeding roots, arising from the laterals in thousands, are produced on all sides of them, but the majority grow upwards. They are easily killed by unsuitable conditions such as frost, drought, lack of aeration, etc., but fresh growths very rapidly resume possession of the soil and in increased numbers as soon as favourable conditions return. This rapid regeneration enables the pecan to withstand much adversity. The feeding roots are associated with a mycorrhiza. Whether this is a necessity for satisfactory growth is not known. It is, however, established that pecans suffering from rosette disease are practically devoid of mycorrhizas. There appears to be a regular cycle of development and decay of feeding roots. A twenty-five year old pecan will have millions of feeding roots during optimum growing conditions in spring and less than one thousand during the dry part of the summer. From tests

carried out with pecans growing near a small stream, where all degrees of soil moisture from wet to dry were present, it was found that the optimum percentage of soil moisture was 12·5. A percentage of 19·5 was too wet and 7·3 was too dry.

484. ANON. 634.574 : 581.163.2
Artificial fertilization of *Pistacia vera*.
Cyprus Agr. J., 1933, **28** : 90-1.
The fact that the flowers of the male tree of this pistache open about a fortnight before those of the female tree is frequently the cause of a poor fruit set. The difficulty can be surmounted in three ways—(1) By grafting a few scions of the male tree upon each female. Both sexes will then flower simultaneously on the one tree. (2) When propagating by grafting only from early flowering female and late flowering male trees and planting in the proportion of 1 male to 4 female trees. (3) By artificial pollination. Pollen can be preserved by spreading cut branches carrying male flowers on wax paper and subsequently bottling the dropped pollen, when thoroughly dry, into airtight sealed glass receptacles. It can then be used for hand pollination. It should be applied by means of small bellows in calm, dry, and settled weather.

The following are also noted :—
HAMOND, J. B. **Some recent investigations into methods of storing walnuts during the winter.** *Gard. Chron.*, 1933, **94** : 2438 : 219-20, bibl. 3.
COLE, J. R. **Vein spot of the pecan caused by *Leptothyrium nervisedum* n. sp.** *J. Agr. Res.*, 1933, **46** : 1079-88.
MINISTRY OF AGRICULTURE. **The cultivation of raspberries.** *Advisory leaflet* **180**, 1933, pp. 4.

PLANT PROTECTION OF DECIDUOUS FRUITS.

485. KLOTZ, L. J. 632.3/8
A résumé of some aspects of disease resistance in plants.
Proc. Xth Int. Hort. Congr., Paris, 1932, Société nationale d'horticulture de France, rue de Grenelle 84, Paris 7e, pp. 87-91, bibl. 53.
This is a short review of the more important findings of late years. Summarizing the writer makes the following points :—In addition to or in place of protective substances normally present in a plant the chemical make-up and sometimes the response of a plant to a disease can be demonstrably altered by artificial treatment or by actual invasion of a parasite. This modification may consist of the production of antibodies or of some simpler toxic materials, such as hydrogen ions or aromatic substances, or by an alteration in the building material normally prepared by the protoplasts. These modifications may be favourable or inhibitive to the development of the parasite.

486. STRICKLAND, A. G. 634.1/2-2.111
Winter and spring injury to deciduous fruit trees.
J. Dept. Agr. Victoria (Australia), 1933, **31** : 384-7.
Winter injury in Victoria is of a somewhat different nature to that experienced in countries subject to severe winter cold. Here it is caused chiefly by waterlogging of the soil by excessive rainfall or injury to blossom and young fruit by low temperatures. In 1931 about 14 per cent. of the total peach area in Shepparton was destroyed by " wet feet ". The symptoms are defoliation, or a failure to leaf in early spring, a brownish staining which extends into the wood of limbs, trunk, and roots, and a sour odour suggestive of fermentation when the wood is cut. Remedies suggested are tile drainage, surface drainage, a cover crop of peas or beans to remove soil moisture by transpiration. Low temperatures in spring may, if severe, kill the blossom ;

even if moderate they may affect the fruit by slowing down the action of the pollen on the stigma to a point when fertilization cannot take place, and, by restricting the flight of bees, prevent the necessary cross pollination. Methods of orchard heating are discussed.

487. THOMAS, H. E., AND MACDANIELS, L. H. 634.11-2.111
Freezing injury to the roots and crowns of apple trees.
Cornell Univ. Agr. Exp. Sta. Ithaca, bull. **556**, 1933, pp. 23, bibl. 24.
The writers discuss the factors that are conducive to freezing injury to stock, to scion and to the whole tree, and the best methods of obviating such injury or nullifying its effects. They consider that careful observation of the incidence of the phenomenon leads to the following inferences being drawn. Where such danger occurs (1) the maintenance of sod mulch or other cover during cold weather minimizes risk of root killing, (2) early doses of quickly available nitrogenous fertilizer will induce better resistant conditions in the trees, (3) the crowns of the trees should not be left exposed by grubbing away the sod for any reason, (4) theoretical grounds exist for supposing that the planting of root grafted rather than budded trees is preferable, (5) varieties known to be tender should be double worked on a hardy intermediate stock. Notes are given on the best tried methods of bridge grafting and approach grafting for the resuscitation of damaged trees.

488. HARRIS, R. V. 632.8 : 634.711
Mosaic disease of the raspberry in Great Britain. I. Symptoms and varietal susceptibility.
J. Pom. Hort. Sci., 1933, **11** : 237-55, bibl. 30.
The writer discusses previous work in this field both in America and Europe. He classifies the leaf symptoms observed on an extensive collection of varieties at East Malling into three types which are described at length. A tentative classification of varieties according to their relative apparent susceptibility as exhibited under East Malling conditions is submitted. Instances of the influence of locality on susceptibility are given.

489. DUFRENOY, J. 632.3/8
Les maladies à virus. (**Parasitic diseases of plants.**)
Proc. Xth Int. Hort. Congr., Paris, 1932, Société nationale d'horticulture de France, rue de Grenelle 84, Paris 7e, pp. 94-127.
The author gives here detailed observations of the interaction of numerous parasitic organisms and viruses with the cell walls and juices of different plants. The pathological changes and the reactions within the cell are noted. Ecological factors of immunity are discussed and the importance of meteorological conditions. The effect of nutrition on resistance is also noted and the different forms of immunity are touched on.

490. THOMAS, H. E., AND PARKER, K. G. 632.314 : 634.13 +634.11
Fire blight of pear and apple. (*Bacillus amylovorus.*)
Cornell Univ. Agr. Exp. Sta. Ithaca, bull. **557**, 1933, pp. 24, bibl. 40.
Their investigations and observations enable the writers to make definite recommendations for the control of this very serious disease. The principal seat of overwintering bacteria is in the living tissues near the margins of cankers on trunks and larger branches of pear and apple and to a lesser extent on related plants. A list of other hosts is given. The widest dissemination is at blossom time by means of insects. The remedy suggested is the drastic surgical removal of trees, branches, blossom spurs and terminals, according to the degree of their infection. The hazards of infection are reduced by not planting such combinations of apple, pear and quince as will merely prolong the blossom period and add to the risk of infection. Reduction of the vigour of trees by withholding nitrogenous fertilizer, while reducing blight, cannot be recommended. The essential is to remove every possible hold-over canker from the orchard and from the immediate neighbourhood before blossom time. All smaller branches and larger ones more than half-girdled should be removed entirely. Next in importance to the

removal of overwintering blight infections is prompt attention to all new infections immediately after blossoming. Frequent inspections should then be made and infected shoots, twigs and small branches should be removed well below the visibly infected area, cankers in larger branches being cut out. Wounds made at this season must be disinfected with a good germicide, e.g. 1 part each of bichloride of mercury and of cyanide of mercury in 500 parts of water. Other suggestions for improving common practice are made, while it is noted that spraying with bordeaux just before or during blossoming has sometimes definitely caused reduction in blight and needs further study.

491. FISH, S. 634.25-2.4

Brown rot in peaches.

J. Dept. Agr. Victoria (Australia), 1933, **31** : 381-3, 387.

Calculations are given to show that the loss to peach growers in the Goulburn Valley from brown rot during last season was £20,000. An investigation of the factors leading to this extensive development revealed that—(1) All brown rot which developed in peaches during cool transport was traceable to some injury received in the orchard. (2) The brown rot developing after the cooled fruit was exposed to the prevailing market temperatures was due to (a) injuries received during transport, (b) rot which obtained entrance through the uninjured skin of the peach when overripe. Injuries received during transport were caused by faulty packing and vibration during a 500 mile journey. The faulty packing consists of the close pressure of the peaches against each other and the sides of the container, the injury taking the form of a slight split in the skin in the crease of the peach. The brown rot appearing in uninjured, ripe peaches is primarily a result of a heavy infestation at blossoming time, the spores being carried through on to the maturing fruit. The heavier the spore dosage the shorter the infection period and the higher the percentage of peaches infected in a given time. To reach the consumer in good condition peaches must remain sound after picking for at least five days at ordinary ripening temperature. Suggestions made to delay the onset of brown rot in ripe, uninjured peaches are (a) picking at the correct stage of immaturity compatible with market requirements ; (b) reduction of delay between picking and pre-cooling ; (c) pre-cooling to 32° F. and the use of refrigerated cars throughout the whole journey ; (d) increased sanitary precautions such as spraying the trees with lime-sulphur or ammonium sulphide (the latter spray being usable without trace up to within a very short time of picking), in addition to the usual bordeaux spray for leaf curl, and burning diseased twigs and mummied fruits.

492. DILLON WESTON, W. A. R., AND PETHERBRIDGE, F. R. 632.42 : 634.11 +634.13

Apple and pear scab in East Anglia.

J. Pom. Hort. Sci., 1933, **11** : 185-98, bibl. 7.

The authors give a full account of their spore trapping experiments. They conclude that aphids are vectors and may be responsible for secondary infection. In the orchards under investigation ascospores played no part in the initial infection of apple or pear scab. Observations showed that pustules on the one-year-old spur wood were common and together with the pustules on the one-year-old, non-fruiting wood were responsible for the primary infection, which took place very early. Splashing experiments, in which drops of water were allowed to fall on to scab pustules, indicate that rain may be important in the primary infection of scab. Scab was more readily controlled by one pre-blossom spraying on varieties which are not susceptible to wood infection than on wood susceptible varieties.

493. FISH, S., AND GREATOREX, S. 634.13-2.42

The control of summer spot of pears. Progress report.

J. Dept. Agr. Victoria (Australia), 1933, **31** : 438-42.

In 1932 black spot disease rendered 25% of the pear crop of Victoria unfit for export. In previous seasons, it is stated, the loss would exceed this figure. The most susceptible varieties are Packham's Triumph, William's Bon Chrêtien, Beurré Rose, Winter Nelis, Vicar of Winkfield.

Varieties having a certain immunity are Winter Cole, Josephine, Howells, Keiffer. The life history of the disease is related. Experimental control methods were initiated at Doncaster to obtain information on the relation of pre-blossom spraying to summer spot development and to determine the effects of a fruit protection spraying in relation to this late infection. The effects of single pre-blossom sprays were compared, given at (a) the bud movement stage, (b) as young folded leaves were protruding from the bud, (c) when young folded leaves were separated from the unopened green flower buds, (d) when the flower buds were showing white. The fungicide used was bordeaux 6-4-40. It was found that the controlling effect of the spray increased with the lateness of application, but in the case of (d) a severe russeting of the fruit occurred later. The amount of summer spot development was closely correlated with the amount of spot development in early spring. In further experiments two pre-blossom sprayings of bordeaux 6-4-40 applied just as the young folded leaves were protruding from the bud and again when they were well separated from the unopened blossom were more effective than two sprayings of lime-sulphur 1-20 applied at the same time. When the two pre-blossom bordeaux sprays were followed by a half strength bordeaux spray applied after the fruit had set, no summer spot occurred, any spots present being old spring spots. When, however, a fruit cover spraying of lime-sulphur 1-80 followed the 2 pre-blossom bordeaux sprayings, summer spot developed. The half strength bordeaux spray caused a light russeting but not sufficient to reduce the grade of the pears below export standard.

494. JOHANSSON, E. 632.42 : 632.952 : 632.943
Besprutings—och bestoftningsförsök med fruktträd. (**Spraying and dusting fruit trees.**) [English summary.]
Sveriges Pomologiska Förenings Årssk., 1933, **30** : 1-14, bibl. 20.
An account of scab control experiments in Sweden in 1931 and 1932 with bordeaux and lime-sulphur sprays, and bordeaux powder (dehydrated copper sulphate and lime) and sulphur compounds as dusts. Scab was controlled by 1-2 pre-blossom treatments with bordeaux spray mixture followed by 2-3 post-blossom lime-sulphur treatments. Bordeaux dust had much the same control effect as bordeaux mixture, but in some cases did more damage to the fruit. Sulphur dusting was about as effective as lime-sulphur spray, both being useful against red spider. Although dusting is generally found less effective against scab than spraying it may, however, often be preferable especially when labour is scarce. [From author's summary.]

495. HEARMAN, JOAN. 634·11-2.42
Control of black spot or scab of pears in Western Australia.
J. Dept. Agr. Western Australia, 1933, **10** : 292-316, bibl. 11.
The experiments were carried out in the 1932-33 season in a badly infected orchard of the susceptible Beurré Bosc and Glou Morceau pears at Mt. Barker. The trees were well pruned at the outset to admit light and air. Ascospores, the chief source of primary infection in spring, were first discharged nearly one month before the trees reached the (illustrated) " green-tip " stage, and continued for three months to be shot from leaves on the ground, although perithecia in leaves buried by early spring ploughing had lost all their spores after two months in the ground. Little correlation was found between ascospore-discharge and weather conditions. Conidia were not an important factor in the spread of scab-infection from tree to tree, and over-wintering in wood lesions was not observed. Autumn spraying of the trees (where heavy infection already existed) with bordeaux mixture or with lime-sulphur failed to check ascospore-discharge the next spring, but early spring ploughing to bury diseased leaves was very beneficial. Bordeaux (5-4-50) applied at " green-tip " and again (3-4-50) at " pre-pink " to " pink-bud ", at petal-fall and ten days later gave very good control without injury at a total cost of 3·56 pence per tree for material. Another spraying after one month's interval improved this control. One bordeaux application at early " pre-pink " gave some control, even where early ploughing was not done. Lime-sulp'ıur, 1 in 15 at " green-tip ", 1 in 35 at " pre-pink " to " pink-bud ", and 1 in 50 at petal-fall and ten days later caused some leaf-burn and was less effective than

bordeaux, which gave protection for a longer period. Beurré Bosc (on which the application at " green-tip " was not made) was more scab-susceptible than Glou Morceau. The morphological features and the annual cycle of the fungus (*Venturia pirina* Aderhold) are briefly described, and the paper is liberally illustrated by photographs, drawings, tabular matter and graphs. M.H.M.

496. GOUDE, H. 634.11-2.42

Scab control on apples.

Ann. Rept. Hort. Superintendent, Dept. Hort. Education, Norfolk County Council for 1932, pp. 7-8.

It is claimed that an alteration of the method of control of apple scab at the Burlingham Horticultural Station has been very successful. The new method used was as follows. On May 4th-9th 1932, when some of the apples were in the mouse ear stage of bud break and others had reached green bud stage, a bordeaux spray 4-18-50 was given. The lime was hydrated lime sold in parchment sacks. One pound arsenate of lead powder to each 40 galls. of bordeaux accounted for any caterpillars. On May 17th at pink blossom stage a dusting of copper dust (20 lbs. per acre) was applied, and repeated on May 21st, 27th and June 1st. Beauty of Bath, Grenadier, Stirling Castle and Cox's Orange Pippin showed spray damage. Bramley's Seedling, Allington Pippin, Worcester Pearmain, Annie Elisabeth, Newton Wonder, Lane's Prince Albert and Norfolk Royal were uninjured. On all trees except the controls there was a large clean crop and scab markings or infection were difficult to find. The control in fact was almost complete. It is pointed out that the weather conditions were dry, and that copper dust applied experimentally under moist conditions produced burning. Cox's Orange Pippin russets so severely that at present copper dust should not be used on it.

497. OGILVIE, L. 632.42 : 634.11

Canker and die-back of apples associated with *Valsa ambiens*.

J. Pom. Hort. Sci., 1933, **11** : 205-13, bibl. 25.

The writer, on examining the incidence of the dying off of branches of apple trees or of whole trees in some five cases, all in different parts of the west country, found that a *Cytospora* sp. was always present. This was isolated and submitted to culture, and was then inoculated on to new apple twigs. The growth and fructifications on this new material is here described and the description is said to agree well with the diagnosis of *Valsa ambiens*. Notes are given on previous references to this fungus in England and to the previous incidence of similar die-back diseases. It is concluded that *V. ambiens* is a weak parasite incapable of attacking healthy trees, but capable, when once established in necrotic areas, of invading healthy tissues.

498. WILLISON, R. S. 634.25-2.3/4

Peach canker investigations.

Scientific Agriculture, 1933, **14** : 32-47, bibl. 11.

This paper forms Part I of a report on investigations carried out at the Dominion Laboratory of Plant Pathology, St. Catharines, Ontario. Cankers on peaches originate from wounds or dead areas. The relative importance of various types of injury as centres of origin for canker are discussed. There is some evidence of differences in varietal susceptibility. Brown rot (*Sclerotinia* sp.) is only of indirect importance in the spread of canker owing to the canker producing organisms obtaining entrance through the twig lesions caused by it. The statement sometimes made that brown rot is itself a cause of canker is here disproved. Canker itself does not appear amenable to control by spraying, but spraying definitely reduced the percentage of brown rot and therefore the twig lesions caused by it. Experiments in cultivation indicated that overstimulated or unbalanced trees and trees " not seasonably mature at leaf fall are more subject to canker than thrifty trees which are properly matured ". The importance of proper pruning methods is stressed. Stubs and pruning wounds made in the dormant season cankered more frequently than those made in the early growing season owing to the longer time in which

they remained uncallused. Wounds made even so late as March were later in closing than wounds made in May or June. Disinfection of pruning wounds was not always satisfactory and often resulted in damage to the trees. It is remarked that properly made pruning wounds show little infection and that the possible benefits of disinfection are likely to be small. Large wounds requiring several years to heal might be treated with disinfectants non-toxic to the living tissue of the tree, or, if toxic materials are used, the vulnerable parts should be first covered with some protective substance. Disinfection with mercuric chloride 1:500 is suggested, with a subsequent protective covering of white lead paste free from turpentine and excess of oil. A number of preventive measures are enumerated, mostly those which should be a matter of routine in careful orchard practice. The identity of the causal organism or organisms is not discussed but will, it is stated, form the subject of future papers.

499. DEY, P. K., AND NIGAM, B. S. 632.42 : 634.11
A soft rot of apple.
Indian J. Agr. Sci., 1933, **3** : 663-72, bibl. 5.
A soft rot of apples in the United Provinces is attributed to *Aspergillus niger*. The softening of the flesh is due to an enzyme secreted by the invading hypha whose progress depends on the killing in advance of the surrounding tissue by this enzyme. The fungus could not enter through uninjured skin. Sour apples are more especially susceptible, the optimum reaction being between +25 and +30 [Fuller's scale] of malic acid.

500. TETLEY, URSULA. 634.22 : 576.3 : 581.144.4
The development and cytology of the leaves of healthy and " silvered " Victoria plum trees.
Ann. Bot. 1933, **46** : 633-52, bibl. 14.
1. An account is given of the development of normal plum leaves from the earliest stages until maturity. The earliest stage is characterized by a high rate of cell division. It is followed by an extension period in which a large amount of readjustment takes place among the mesophyll cells. This gives rise to the intercellular space system, and finally the mature structure of the leaf. 2. The nuclear divisions of normal plum leaves and the senescent changes in the mesophyll cells are described. 3. The development of silvered plum leaves is compared with that of normal leaves. Differences in the nuclear divisions of silvered leaves in the meristematic stages are described. The frequent inhibition of cell division in the palisade before the cessation of the extension of the epidermal cells is correlated with the subsequent separation of the epidermis from the palisade. 4. Details of the cytological features of developing and mature silvered leaves are given. It is shown that silvered leaves pass through senescent changes similar to those of normal leaves, but earlier in the season and at a much greater rate than in the latter. [Author's summary.]

501. DEARNESS, J., AND FOSTER, W. R. 634.714-2.42
Anther and stigma blight of loganberry.
Canadian J. Res., 1933, **9** : 43-8, bibl. 2.
The presence of a fungus, *Hapalosphaeria deformans* Syd., on the anthers and stigmas of loganberries is reported from British Columbia. This fungus has not hitherto been known in N. America. The fungus prevents pollination of a number of the drupelets with the result that the fruit is deformed. The fungus is known in the Old World as a parasite of raspberry and is thought to have invaded America by the North-West.

502. BERKELEY, G. H. 634.75-2.4
Strawberry root rot in England.
Nature, 1933, **132** : 570, bibl. 3.
The writer who has worked for some time on this problem in Canada has found disease symptoms present in English strawberry fields similar to those noted in " root rot " disease in Canada.

He has in England been successful in isolating certain organisms from those rots, and on re-inoculating with one of them grown in culture, a species of *Coniothyrium*, he has produced typical root rot lesions.

503. NEWCOMER, E. J. 632.7
Orchard insects of the Pacific North-west and their control.
U.S. Dept. Agr. circ. **270**, 1933, pp. 76.
A short account is given of the characteristics, life history and control of some 34 insects harmful to pears or apples, and of the more important pests harmful to cherries, prunes and plums, peaches and walnuts. A note follows on the beneficial insects found. The following spray materials are considered :—lead arsenate, fluorine compounds, lime-sulphur, oil emulsions, nicotine, pyrethrum, as also spreaders and stickers. Finally notes are made on such subsidiary control apparatus as dusting materials, tree bands, insect baits, orchard sanitation.

504. PETTIT, R. H. 634.8-2.7
The principal grape insects of Michigan.
Michigan State Coll., Agr. Exp. Sta., special bull. **239**, 1933, pp. 18.
An account is given of some 19 harmful insects and recommendations are made for their control, in which the desirability of avoiding lead arsenate is kept in mind. It is noted that certain of them hibernate under rubbish, while others can maintain themselves entirely on wild grapes and in neglected vineyards. The moral is obvious.

505. GLEISBERG, W., AND MENTZEL, F. 632.951.4
Die physiologische Wirkung von Obstbaumkarbolineum. (Methodik einer allgemeinen biologischen Prüfung der Obstbaumkarbolineum.) (**The physiological effects of fruit tree winter washes. The conduct of a common biologic trial of such sprays.**)
Gartenbauwissenschaft, 1933, **7** : 711-45, bibl. 12.
The writers have examined the physical properties of a large number of winter washes, including their specific weights, viscosities, emulsifying capacity, insecticidal powers and effect on plants. They consider that the two last qualities are of the greatest possible importance to the user, while the emulsifying power and persistence of emulsion are only important as influencing them. A comparison of insecticidal and phytotoxic effect shows that these have no definite relation with one another. Winter washes of good insecticidal power may be either harmless or harmful to plants, although generally speaking the lower the insecticidal value of a wash, the less harmful is it to plants. From this it may be concluded that phytotoxic components have also insecticidal effects, but not that insecticidal components are of necessity phytotoxic. It must be so arranged that a wash shall cause the minimum damage to plants commensurate with adequate insecticidal effects. Experiments noted here indicate that the effect of poor emulsifying capacity and keeping capacity is not so much to depress insecticidal power as to increase damage caused to the plant. Specific weight and viscosity are not found to bear any relation to insecticidal and phytotoxic capacity. Specific weight has the greatest effect on phytotoxicity in cases where it impairs the keeping quality of emulsions, i.e. very rarely.

506. GLEISBERG, W. 632.951.2 : 547.562
Die Wirkung von Phenolpräparaten auf gärtnerische Kulturpflanzen. (**The effect of phenol preparations on cultivated garden plants.**)
Gartenbauwissenschaft, 1933, **7** : 678-710, bibl. 6.
The author describes experiments on the insecticidal and phytotoxic effects of two sprays, " Lysol " and " Kreolin ", the composition of which is given. Both contain phenols in definite amounts. The following facts were noted. Increasing concentrations of kreolin or lysol in water led to disintegration of emulsions and changes in their character. Changes in concentration also produced changes in surface tension, by which the wetting capacity of the medium is

determined. Both sprays did damage to tradescantia, pelargonium and fuchsias at such low concentration as 0·25%, 0·75%, etc. For winter spraying of fruit trees both could be used in 10% solutions, for spring and summer spraying kreolin could not be used in stronger solution than 0·75%, nor lysol higher than 1·5%. Both were found good against woolly aphis in consequence of their wax solvent properties. The wetting capacity is in both cases increased by the addition of soft soap. Cotton seed oil soft soap proved the most effective in this connection. The wetting capacity of soap solutions is evidently increased by standing for several days. Cabbages are damaged by 1% solutions of lysol and killed by 2% solutions. The use of lysol and kreolin for soil disinfection led to growth being checked in cabbages. The destruction of *Plasmodiophora brassicae* by treatment was not clearly proved.

507. CUNNINGHAM, G. H., AND MUGGERIDGE, J. 634.1/2-2.951.8
Orchard sprays in New Zealand. V. The oil series.
New Zealand J. Agr., 1933, **47**: 8-18, 89-95, bibl. 35.
The authors review in some detail investigations undertaken in other countries to ascertain the factors by which the effects upon plants and insecticidal properties of oil spray, both tar oil and petroleum, are gauged. They then apply this information to New Zealand conditions.

508. HEY, J. L., AND THOMAS, I. 632.78
On the biology of *Cacoecia crataegana* Hub. (*Lepidoptera: Tortricidae*) on fruit trees in the Wisbech area.
Ann. Appl. Biol., 1933, **20**: 439-62, bibl. 25.
The authors give a very full illustrated account of the anatomy and biology of the larva and pupa of this moth, as well as of its observed life history and habits. Host plants regarded are fruit trees, aspen, poplar, oak, hazel, birch, sycamore and sallow. As it feeds only on well developed leaves, it is only of great economic importance when present in very great numbers in commercial fruit orchards. A note is given on the parasitism of the moth.

509. PETHERBRIDGE, F. R., AND OTHERS. 632.793
On the biology of the plum sawfly, *Hoplocampa flava* L., with notes on control experiments.
Ann. Appl Biol., 1933, **20**: 429-38, bibl. 7.
The writers' own observations lead them to conclude that damage done to plums in this country may be attributed to *H. flava* and not to *H. fulvicornis*, as previously thought. The life history is detailed and notes made on variation of intensity in attack during the years 1925-1932. Control measures successful in 1929 but unsuccessful in 1932 are noted.

The following also are noted:—

HASE, A. Schäden durch Pflaumensägewespen als Beitrag zur Feststellung der Höhe von Insektschäden sowie Bemerkungen über Statistik in der angewandten Entomologie. (**Plum sawfly damage as an aid to the determination of insect damage together with remarks on statistics in applied entomology.**) *Gartenbauwissenschaft*, 1933, **8**: 114-24.

LOEWEL, E. L. Der augenblickliche Stand der Mittelfrage in der Fusicladiumbekämpfung in niederelberschen Obstanbaugebiet. (**Present control methods used against *Fusicladium* in the fruit districts of the lower Elbe.**) *Gartenbauwissenschaft*, 1933, **8**: 125-34, bibl. 9.

BARNES, H. F. **A cambium miner of basket willows (*Agromyzidae*) and its inquiline gall midge (*Cecidomyidae*).** *Ann. Appl. Biol.*, 1933, **20**: 498-519, bibl. 18.

GINSBERG, J. M. **Laboratory tests with various fumigants on codling moth larvae.** *J. Agr. Res.*, 1933, **46**: 1131-6, bibl. 8.

VEGETABLE GROWING.*

510. VON SENGBUSCH, R., AND WEISZFLOG, J. 635.64-1.523
Die Züchtung von wohlschmeckenden Tomaten. Die züchterische Bedeutung des Zucker—u. Säuregehaltes. (Breeding for flavour in tomatoes. The importance to the breeder of the sugar and acid content.)
Züchter, 1933, **5** : 169-73.

This is an account of work at the Kaiser Wilhelm Institute, Müncheberg. The writers summarize as follows :—Many individual factors are responsible for the taste of fruits, such as kinds of sugar, different acids, aromatic substances, unchanged flavouring substances and consistency of fruit. A method for determining taste factors needs working out. The work discussed in this article deals with the sugar and acid contents of tomatoes, sugar being determined by the refractometer, acids by titration. Changes in sugar content were determined during ripening and under different weather conditions. The results allow separation of tomatoes into 4 extreme groups, showing respectively (1) Low sugar and low acid content, (2) Low sugar and high acid content, (3) High sugar and low acid content, (4) High sugar and high acid content. *Solanum racemigerum* and some wild forms of *S. lycopersicum* are found to be particularly rich in both sugars and acids. The sugar content of the F 1 generation of the *S. lycopersicum* × *S. racemigerum* cross is only insignificantly higher than that of the low sugar parent. The average sugar content of the F 2 generation does not differ much from that of the F 1 plants. Individuals do occur, however, which are particularly rich in sugars and in acids and in this respect reach the level of the parents. In one F 2 generation four types were found showing very high sugar content which was repeated in subsequent generations. No correlations, which might be to the detriment of breeding work, could be established between sugar content and weight of fruit or between acid content and weight of fruit. Only a slight correlation exists between sugar and acid content. Finally the possibility of breeding tomatoes for use as fruit is discussed.

511. ORMAN, A. C. 635.64-1.8
Fertilizers essential to successful tomato growing.
Agr. Gaz. New South Wales, 1933, **44** : 509-11.

Field manurial trials with a private undistributed variety, Sunnybrook Earliana, and with Break o' Day, an American variety (which failed to live up to its American reputation of resistance to *Fusarium* wilt) are reported. A treatment of 560 lbs. per acre of M. 22 mixture (equal parts superphosphate and bonedust) at time of transplanting to the field, followed by a top dressing of 280 lbs. per acre of P 11 (6 parts superphosphate, and 1 part sulphate of ammonia) about 3 months later yielded an increase of 310 half bushel cases per acre over the unmanured controls.

512. AINSWORTH, G. C. 635.64-2.8
An investigation of tomato virus diseases of the mosaic " stripe ", streak group.
Ann. Appl. Biol., 1933, **20** : 421-8, bibl. 13.

Ordinary tomato mosaic has been identified as true tobacco mosaic and is found not to be implicated in most of the " stripe " disease. Stripe may be due to several causes. In this paper it is differentiated as *stripe*, when attributed to *Bacillus lathyri*, *glasshouse streak* when caused by a single virus, and *streak* when due to a mixed virus infection. Descriptions are given and comparisons made between all the above and between them and spotted wilt. [From author's summary.]

513. NIGHTINGALE, G. T. 635.64 : 551.52 : 581.13
Effects of temperature on metabolism in tomato.
Bot. Gaz., 1933, **95** : 35-58, bibl. 36.

Plants were grown in sand culture in glass enclosed chambers in which humidity was maintained throughout at 85%. Sunlight and carbon dioxide supply varied, but at any given time were

* See also 439, 506, 526.

the same for each temperature treatment. The relative differences in growth and metabolism at 55°, 70° and 95° F. are described and discussed.

The following also is noted :—

SAYWELL, L. G., AND CRUESS, W. V. **The composition of canning tomatoes.** *Univ. Calif. Agr. Exp. Sta. bull.* **545**, 1932, pp. 32, bibl. 25.

514. PIRONE, P. P., AND OTHERS. 635.41-2.4

Copper seed treatments for the control of damping off of spinach.

Cornell Univ. Agr. Exp. Sta. Ithaca, bull. **566**, 1933, pp. 25, bibl. 11.

Damping off caused by *Pythium ultimum* and other fungi has been excellently controlled by soaking the seed for an hour in approximately a 1% solution of copper sulphate or shaking it with cuprous oxide powder until thoroughly coated, using 1 level teaspoonful of powder to 1 lb. of seed or 1 lb. of powder to 65 lbs. of seed. Other seed treatments not so successful included copper carbonate, semesan, copper sulphate monohydrate, calomel and mercuric chloride, all in the dry form, and mercuric chloride in solution.

515. CHARLES, VERA K., AND LAMBERT, E. B. 635.8

Plaster molds occurring in beds of the cultivated mushroom.

J. Agr. Res., 1933, **46** : 1089-98, bibl. 14.

The writers describe various moulds growing in mushroom beds. They do not deal with their control. The fungi concerned are white plaster mould (*Monilia fimicola*), brown plaster mould (*Myriococcum praecox*), and *Monilia sitophile*, the latter occurring as a troublesome contaminant in the manufacture of spawn both in the U.S. and in Europe, though seldom if ever found in composted manure with the two previous moulds.

516. PAUL, W. R. C. 635.35

A note on the cultivation of the cauliflower in the low-country districts of Ceylon.

Trop. Agriculturist, 1933, **81** : 91-4.

Unexpected success has attended the trials carried out with cauliflowers at low elevations in Ceylon. Hitherto their cultivation has been restricted to the higher elevations of about 4,000 to 6,000 ft. The variety giving the best results was Patna, an Indian strain reported to be acclimatized to low elevations in India. Instructions are given for the proper cultivation of this vegetable under Ceylon low-country conditions.

517. KRÄUSS, J. 631.416.13

Nitratgehalt gärtnerischer Kulturerden. . . . . (**Nitrate content of market garden soils. A quick method for the approximate estimation of nitrate nitrogen in the soil by the help of permanent standard colour tubes.**)

Gartenbauwissenschaft, 1933, **7** : 639-45, bibl. 8.

The author has been trying to find a more satisfactory method than that of Morgan, who uses Ridgways Colour Standards, since Morgan's colour reaction of nitrate with diphenylamine is not specific for nitrate, being subject to influence by other oxidizing substances. It has now been found that the colour of the ammonium salt of nitrated phenol disulphonic acid can be matched by dilute solutions of potassium chromate or bichromate, which may be used as permanent standards. The author describes a method of making the tubes and the phenol disulphonic acid and of carrying out the analysis. He notes that determination of phosphates presents no difficulty and promises an account of a quick method of determining potash deficiency or excess at a future date.

518. SCHWARTZ, J. 631.462
Bodenregeneration durch Dampfbehandlung gärtnerischer Kulturerden. II. Die Wärmeverteilung im Boden. (**Garden soil improvement by steam treatment. The distribution of warmth in the soil.**)
Gartenbauwissenschaft, 1933, **7** : 636-72, bibl. 8.

Four types of apparatus are described. The " pan " is made of wood, lined with lead, and measures 130×250×16 cm. It is laid upside down on the soil and has extending iron sides which go down into the soil and prevent escape of steam. Steam is introduced from above. The " harrow " is shaped like a harrow, the prongs being formed by tubes. The steam passes through holes about 20-25 cm. below the soil surface. The whole is covered with a pan to prevent escape of steam. The " grid " is laid in the soil and has soil heaped on it. It is provided with holes for the emission of steam. The fourth apparatus described is a transportable truck fitted with tubes. This is attached to a low pressure boiler and the soil is heaped into it and treated. Temperature determination presents a problem. The author describes with diagrams a method of measuring by means of thermoelements. In this case a measuring staff is inserted in the soil and connected at different levels with thermoelements. The temperatures may then be read above ground by means of a millivoltmeter. Such a system is preferable to that in which ordinary thermometers are used, the latter being very easily broken. The advantages and disadvantages of the different devices are discussed.

FLOWER GROWING.*

519. MACLAGAN, J. F. 635.9 : 631.547.4 : 551.56
Date of flowering as affected by climatic temperature.
Plant Physiol., 1933, **8** : 395-423, bibl. 7.

Observations were made on species of *Rhododendron*, *Cytisus* and *Syringa* at The Royal Botanic Garden, Edinburgh. They lead the author to make the following deductions :—(1) The actual date of flowering of any species in any year may vary from the average date. (2) Such aberration is referable to the temperatures obtaining during narrow belts of time. (3) These belts vary between genera as to the remoteness from the actual date of flowering and here are referred to the periods of activity in gamete formation. [Author's summary.]

520. SCHOENER, J. M. A. 635.937.34-1.523
The hybridization of roses in America.
Proc. Xth Int. Hort. Congr., Paris, 1933, Société nationale d'horticulture de France, rue de Grenelle 84, Paris 7e, pp. 222-35.

After noting in detail the wealth of *Rosa* species available for breeding work the author deals with achievements to date. One of the earliest crosses was made in 1816 between *Rosa chinensis* and *R. moschata*. In 1849 the wild species were utilized for the first time in America, *R. setigera* and the so-called Prairie Rose being crossed with *R. gallica*. Later the famous American Pillar also arose by crossing *R. setigera* with a red *R. setigera* hybrid. The best *R. setigera* seedling is considered, however, by the author to be *R. setigera Michigan superba*. Another early and successful cross was that between *R. humilis* and *R. rugosa*. Other successful combinations result from crosses of *R. rugosa* × *R. blanda*, and *R. blanda* × *R. indica*, the last being a successful attempt to combine the ancestor of the Tea roses with one of the hardiest native American species. Other specially interesting crosses are hybrids between *R. nutkana* and *Paul Neyron*, *R. cinnamomea*, and other species or varieties, *R. carolina* and *R. rugosa*. A discussion follows on the next steps which in the author's opinion offer the greatest hope of successful results. He does

* See also 506.

not agree with Hurst's theory that a loss of fertility may be experienced owing to losses of septets of chromosomes occurring where a simple diploid species is crossed with a polyploid one, since he considers that practical experience does not bear this out.

521. ZIMMERMAN, P. W., AND CROCKER, W. 632.184 : 635.937.34
The injurious effect of mercury vapour from bichloride of mercury in soil of rose houses.
Boyce Thompson Institute Professional Paper, 1933, **1** : 23 : 222-5, being reprinted from *The Florists Exchange and Horticultural Trade World*, 1933, vol. **81**, No. 21.
The addition of bichloride of mercury to rose soils for the purpose of killing earthworms has been found to result in peculiar injury to the peduncles and in browning of the petals in immature buds. This injury is found to be worse when the soil is rich in tankage or other organic matter, the organic matter of the soil reducing the bichloride to metallic mercury the vapours of which rise into the air and damage the buds.

522. BARTON, LELA V. 635.936.751
Germination and storage of delphinium seed.
Boyce Thompson Institute Professional Paper, 1933, **1** : 26 : 248-50.
The operations involved are very simple. Annual seeds germinated readily at temperatures of from 59° F. to 68° F. At higher temperatures poor stands of seedlings were got from good seed. Perennial seeds had a wider effective range of temperature in which they germinated, namely 59° F. to 86° F. Fresh air-dried seed stored in sealed containers at 46° F. retained their ability to produce a good stand of seedlings for 4 years or longer.

523. HUISMAN, E., AND HARTSEMA, A. M. 635.944
De periodieke ontwikkeling van *Narcissus Pseudo-Narcissus* L. (**Periodical development of *Narcissus Pseudo-Narcissus* L.**) [English summary, 15 pp.]
Med. Lab. v. Plantenphysiologisch onderzoek, Wageningen **38**, 1933, Op. 55, bibl. 27, being *Overdruk uit deel* **37** *Mededeelingen v. h. Landbouwhoogeschool.*
The development cycle of *Narcissus* King Alfred is studied. A complete description is given of the composition of the bulb and the development of leaf and flower is minutely traced. All the essential points of the investigation are recorded in the very full English summary.

524. NEWTON, W., AND OTHERS. 635.944-1.531.17
Sterilization of narcissus bulbs by immersion in silver nitrate potassium cyanide solution in vacuo.
Canadian J. Res., 1933, **9** : 31-42, bibl. 7.
The aim of these experiments was to find an alternative to the water sterilization methods. Through the use of a dye solution evidence was obtained that a liquid disinfectant may be forced into the narcissus bulb parts invaded by nematodes and fly larvae by immersion in vacuo. An investigation of the lethal properties of solutions against nematodes and their influence upon bulb growth led to the selection of silver nitrate as a disinfectant, but owing to the instability of silver nitrate in the presence of chlorides and other substances in tap water and in dirt clinging to the bulbs, its use had no commercial possibilities. However, when this silver salt was combined with potassium cyanide in the ratio of 1 to 3 by weight, an effective solution of satisfactory stability was obtained. A solution of silver nitrate 0·05% and potassium cyanide 0·15% by weight, forced into narcissus bulbs by an evacuation process, effectively destroyed bulb nematodes and bulb fly larvae without significant injury to bulb growth under greenhouse conditions. Field tests with bulbs treated in silver nitrate-potassium cyanide solutions resulted in the reduction of infection from 26·8 to 1%, a 96% control, and no evidence of injury to the foliage or bloom was detected. [Author's summary.]

525. ZIMMERMAN, P. W., AND HITCHCOCK, A. E. 635.976.84
Selection, propagation and growth of holly.
Boyce Thompson Institute Professional Paper, 1933, **1** : 27 : 252-60, bibl. 4.

This consists of a short review of published work on the subject, which is followed by a report of recent experimental results. The hollies concerned are *Ilex opaca* Ait., *I. Aquifolium* L. and *I. cornuta* Lindl. Notes are given on the fruiting characteristics and on the variations of holly species. A planting technique is given for propagation from seed and it may be noted that in one year from planting in frames only some 10-15% of the seed is likely to germinate, in the second year the total should reach 50% and in the third year a further 10-15% may be expected to germinate. Notes are given of propagation from cuttings in frames. Experiments made in 1932 show that cuttings can be propagated without the use of a greenhouse. *I. cornuta* can be propagated thus at any time of the year. Summer or autumn cuttings of *I. opaca* were successful, but not so those taken in spring. In the hope that a method might thus be discovered whereby it would be possible to select types of cuttings which would grow upright from the first, the terminals from each of 50 trees growing in the woods were compared with cuttings from the sideshoots of the same trees. None of the plants in either case initially grew upright, so that such selection would not appear of any use. Growth from cuttings may be much faster than from seed. Finally the best method of transplanting is previously to ball the roots with burlap. If, however, the roots are bereft of soil before transplanting, copious watering will be necessary for a month afterwards.

526. ZIMMERMAN, P. W., AND HITCHCOCK, A. E. 581.144.2 : 547.313/314
Initiation and stimulation of adventitious roots caused by unsaturated hydrocarbon gases.*
Contrib. Boyce Thompson Inst., 1933, **5** : 351-69, bibl. 2.

Species of the following were induced to grow roots from young stem tissue by exposure to acetylene, propylene and ethylene gases, the most effective ranges of the different gases being ethylene 0·2% to 0·001%, acetylene 1·0% to 0·1%, propylene 1·0% to 0·1% :—balsam, begonia, bryophyllum, coleus, cosmos (common and sulphur), fuchsia, galinsoga, heliotrope, hydrangea, marigold, popcorn, tobacco, tomato. Notes are given as to the time and place of appearance of roots in each case. Rooting from the lower side of leaves was induced in tomato, cosmos, marigold and heliotrope. As regards hardwood cuttings exposure to acetylene, propylene, illuminating gas and ethylene was found to stimulate latent root primordia in willows. Herbaceous types like tomato, marigold, etc., produced roots more readily and abundantly when exposed to gases. Roots produced on the plants kept continuously in gas had many more hairs than the controls. The use of acetylene, propylene and ethylene changed the orientation of roots in marigold and tobacco, so that potted plants possessing many roots near the surface of the ground at the time of placing in a gas chamber sent roots up out of the ground. No vegetative shoots were induced by any of the three gases and it would appear that these chemicals are specific for the initiation of roots.

527. BRIERLEY, P. 635.944-2.8
Dahlia mosaic and its relation to stunt.
Boyce Thompson Institute Professional Paper, 1933, **1** : 25 : 240-6.

Mosaic is found to be one of the causes of so-called " stunt " in dahlias, the types of stunt differentiated as dwarf, rugose rosette, rugose mosaic and veinal mosaic all being induced by it. The symptoms in such cases include a yellowish or pale green banding along the midribs and larger branch veins of affected leaves. Dwarfing is a second type of symptom evident in mosaic plants of all but the most tolerant varieties and includes shortening of the roots. Insect injuries may resemble mosaic stunt in their grosser effects but can generally be distinguished from it. *Myzus persicae* is proved to be a vector and should therefore be controlled by fumigation of

* See also *H.A.*, 1933, 3:3:293.

seedlings with nicotine once a week in the greenhouse. Selection and isolation of disease-free plants and periodic rogueing are recommended. [See also the writer's account of his own investigations in *Contrib. Boyce Thompson Inst.*, 1933, 5 : 235 : *H.A.*, 1933, 3 : 3 : 365.]

The following also are noted :—

DENNY, F. E. **Effect of ethylene chlorhydrin vapors upon the chemical composition of gladiolus corms.** *Contrib. Boyce Thompson Inst.*, 1933, 5 : 435-40, bibl. 4.

CARLSON, MARGERY C. **Comparative anatomical studies of Dorothy Perkins and American Pillar roses. I. Anatomy of canes. II. Origin and development of adventitious roots in cuttings.** *Contrib. Boyce Thompson Inst.*, 1933, 5 : 313-30, bibl. 11.

CITRUS.*

528. MAZOE CITRUS EXPERIMENTAL STATION. 634.3 (058)

Report for period ending Dec., 1932.

British South Africa Company publ. 2, 1933, pp. 192 and xx.

This is the first annual report of the citrus experimental station recently established with Dr. W. J. Hall as Director by the British South Africa Company at Mazoe, Southern Rhodesia. The research work at this station will naturally be concerned mainly with those problems whose solution is of direct consequence to the plantations of the Company, nevertheless, since the problems of these plantations (which contain about 50% of the total citrus population of the country) are representative of those of the Rhodesian groves in general, the work done cannot fail to be of value to all growers in the Colony. The Director's report, pp. vii-xx, gives a note of the events which led to the establishing of the station in 1931, a progress report of work already in being and a programme of research for 1933. Of the research programme important items are :—attempts to devise a control for soft scale, the completion of the study of the false codling moth now in hand, soil reconnaissance and analysis to discover the penetration of soluble plant foods into the soil column as a result of fertilizing in the irrigation water in 1932, improvement of methods of making synthetic manure, and more extensive laboratory work on coarse fruit and small gummed fruit. In the plant pathology section it is hoped to incorporate wastage experiments with export consignments of fruit, and the development of stem and centre rots in connection with the ethylene colouring treatment will also be studied. The horticultural programme which is necessarily a long range one consists mainly in working up a stock of plants to form the subject of future experiments, in bud selection, particularly the transmission of good and bad qualities, and in the budding of the stocks to be used in the stock scion relationship trials. Following the Director's report are five papers by members of the staff. *See* 533, 534, 538, 540, 597.

529. CASELLA, D. 634.3 : 338

Orientamento della produzione agrumaria. (**The organization of citrus production.**)

Ann. R. Staz. Sper. Frutticoltura e di Agrumicoltura, 1933, 1 (N.S.) : 21-41.

The writer surveys shortly and concisely the present position of citrus production in Italy and the steps which are being taken to standardize production on a high level. Lemons are responsible for nearly 55% of the total citrus production, oranges come next with some 37%, and are followed by bergamots 4% and mandarins 3%. Various cultural practices are touched on and the most promising varieties for different purposes are discussed. It is interesting to note that the writer has recently initiated large scale experiments at Acireale on the selection of sour orange (for rootstocks), on new rootstocks and on top working. The Ministry of Agriculture and Forests has lately set up a committee of which the writer is a member to consider how to develop home

* See also 597-602.

citrus production with a view to keeping old markets and gaining new ones. The chief points which are to-day demanding and will receive the attention of this committee are here noted.

530. BATES, G. R. 634.3-2.4 : 581.471
Oil glands of citrus fruits as an avenue of infection.
Nature, 1933, **132** : 751.
The writer's inoculation experiments show that the oil glands provide a favourable avenue for infection by *Penicillium*. This emphasizes the necessity for care in handling citrus fruits so as not to bruise them.

531. CLARK POWELL, H. 634.3 : 338
The economic importance of the citrus industry in South Africa.
Univ. of Pretoria publ., ser. 1, **24**, 1933, pp. 24.
The present position of the citrus industry in South Africa is reviewed from an economic standpoint. At present this is distinctly favourable. The author stresses the importance of the Ottawa agreements in giving South Africa an opportunity for competing in the markets of the U.K. on very favourable terms and urges growers to seize this opportunity which may by no means be permanent, and by shipping only high grade fruit to create a demand for South African oranges which will prove lasting. The need for a scheme whereby marketing overseas is done only through the Citrus Exchange under a national brand, which should be a guarantee of the highest quality, is regarded as an essential step both to maintain prices and to establish confidence with buyers. The manner in which such an exchange would operate both at home and in the purchasing countries is worked out and given here in some detail.

532. TANAKA, T., AND TANAKA, Y. 634.3-1.541.11
Propagation of citrus fruits in Japan.
Repr. Memoirs Tanaka Citrus Exp. Sta., Vol. **1**, No. 2, 1932, pp. 11, bibl. 12, being *Communication of Hort. Institute, Taihoku Imperial Univ.*, **10b.**
The most popular rootstocks for citrus in Japan are the trifoliate (*Poncirus trifoliata* Linn) and the Yuzu (*Citrus junos* Sieb apud Tanaka). Trifoliate Stock is well adapted to the Satsuma, the principal orange grown. In spite of its dwarfing effect it does not shorten the life or suppress the vigour of the scion. It is unsuitable for lemon in Japan. The Yuzu is an old fashioned stock now discarded by nurserymen in favour of trifoliate. Yuzu trees are found mainly in private hands, and the fruit being very marketable when packed small and green, ripe seeds are hard to come by in sufficient numbers for commercial use. Yuzu is deep rooted and long lived, but is usually planted on shallow soil as a check to the exuberance of its growth. The quality of the fruit of trees on Yuzu root is considered much superior to that on trifoliate. The results of tests of the comparative value of trifoliate and Yuzu conducted at the Government Horticultural Station at Okitsu over a number of years may be summarized as follows :—Trifoliate averages 30 seeds per fruit, 3,000 to a litre and, being polyembryonic, two or three plants per seed. Yuzu averages 20 seeds per fruit, 2,000 to a litre, is monoembryonic and takes two or three weeks longer to germinate. Trifoliate can be grafted in the second year, Yuzu not till the third. Trifoliate bears earlier and has a dwarfing effect. Yuzu grows much faster and forms an altogether bigger tree, while for the first few years the Satsuma fruit on it is rough skinned and acid, though as the tree matures it becomes smooth skinned and of good quality. Yuzu stock is often compatible with varieties which fail on trifoliate, such as Thompson Navel orange, in the case of this tree proving superior also to sour stock. A Yuzu rootstock is often inserted to prolong the life of old Satsumas on trifoliate, the combination of the two roots on the same plant apparently proving very satisfactory. Dealing with other stocks the bulletin gives a table showing reciprocal grafting and its results between 28 different varieties of citrus growing in Japan. Trifoliate and Yuzu stocks will root from cuttings but are usually raised from seed. [The author says that the variation in the seedlings is very small.—ED.] The plants are grafted at 2 years and 3 years for trifoliate and Yuzu respectively in April in Japan and February in Formosa. Spring or summer shoots, 5 cm. long and carrying two buds, are used for scions, summer shoots being

preferred as being longer and easier to handle. About 1,100 of such scions weigh 1 kilogramme. The method employed is veneer crown grafting.

533. BATES, G. R. 634.31-1.547.6
Maturity test data, 1932.
Mazoe Citrus Exp. Sta. Rept. for 1932, being *British South Africa Co. publ.* 2, 1933, pp. 177-92, bibl. 4.

This paper discusses the results of 394 maturity tests, both routine and experimental, on oranges during the 1932 season. The sugar acid tests, the percentage acid tests and the soluble solids content tests are summarized by means of tables. The variety tests are discussed more fully. The changes in the composition of certain varieties throughout the season are followed up, as are changes in composition during storage. The following points arising out of the maturity test data are discussed, (a) date of picking, (b) effect of local conditions on tests, (c) effect of size of fruit and age of tree on maturity.

534. MORRIS, A. A. 634.3-1.4
Preliminary investigations into soil conditions and observations on field practices on Mazoe Citrus Estate.
Mazoe Citrus Exp. Sta. Rept. for 1932, being *British South Africa Company publ.* 2, 1933, pp. 52-102, bibl. 8.

Part I describes the physical and chemical characteristics of the soils on the Mazoe Citrus Estate. Part II discusses irrigation. Two methods of furrow irrigation are practised on the estate. (1) Innumerable, very shallow furrows are drawn between the tree rows. From these two or three very winding (to check erosion) channels branch off to each tree, passing well under its drip. The ground is cultivated and the channels are re-made after each irrigation. (2) Four channels running the whole length of the irrigation lead are drawn with the plough between each row. " From the furrow nearest the lower tree row a circular shallow dam is constituted outside the drip of the trees. This is flooded and insures a heavy irrigation of the top side of the tree." Comparing the merits of the two methods it is considered that No. 1 is superior for the following reasons. Root activity in Citrus is most pronounced and the fibrous root development greater within rather than without the drip of the tree (Waynick, D., Efficiency in fertilizer applications, *Calif. Citrograph*, 1931, Vol. 16, No. 6). The trees on the estate that have been watered in this way for years show no evidence of collar rot due to the too close approach of water to the bole of the tree, so that this reputed danger seems illusory. A system of many shallow furrows tends less to localize the water supply than would a few well defined deeper ones, better ensures penetration of water owing to reduced flow, and interferes less with root development in the surface soil layer. Basin irrigation is not much practised but it is recommended for trial particularly on gradients where, owing to the steepness of the slope, the water in furrowed irrigations cannot properly be controlled. An important advantage in the basin system is that soil erosion is merely from basin to basin, a distance of 24 ft., instead of the whole length of the grove. The ill effects arising from irrigation under certain local conditions (alkali injury, mottle leaf, chlorotic leaf), are reviewed and means of prevention suggested. The system of cover cropping, as at present practised on the Mazoe estate, is considered and criticized in Part III. Certain disadvantages are revealed such as the competition for water, light, air and plant foods between the trees and a vigorous cover crop, the absorption of broadcast fertilizers by the cover crop before they can penetrate to the tree roots, and the fact that under local conditions the cover crop grows so rankly that only a plough is capable of turning it in, with resulting damage to the tree roots, so that even when free of the cover crop the power of the tree to obtain its full nourishment is still impaired. It is suggested that these circumstances could be combated by a modification of the present system whereby the cover crop would be planted at the first irrigation after picking and disked in in November, so that the whole rainy season would be available for decomposition to take place. The increased humidity round the tree due to the transpiration of the cover crop might also, it is thought, minimize the October drop attributed to the dry conditions prevailing at this time of year. The development of coarseness in Valencia fruits, which

often occurs with suddenness at picking time and is associated with years of high rainfall, is considered and its connection with the cover crop is postulated. Field and laboratory investigations of this phenomenon are in progress. The occurrence of small hard fruits containing gum pockets which, particularly in eroded areas, develop from fruits apparently normal during immaturity, points to a suddenly arrested development and is possibly connected with root damage caused by the ploughing in of the cover crop in shallow land. Part IV is concerned with the supply and storage of kraal manure and with the manufacture of synthetic manures by the addition of chemicals to vegetable matter. Part V contains recommendations for fertilizer treatment of various parts of the estate.

535. OWEN, R. C. 634.3-1.541.44
A convenient method of topworking citrus trees.
J. Dept. Agr. Western Australia, 1933, **10** : 270-2.

The method advocated is the side bark graft. A T incision is made in the bark of the selected limb, and the scion wood containing 2-3 buds and previously cut diagonally to a chisel point is inserted. A piece of bark immediately above the T may be removed to make the scion fit snugly. The graft is then bound in and waxed over. The scion usually remains dormant after healing till the tree is cut back. As soon as this is done it begins to grow vigorously. The best time for this work is spring, though any time when the sap is flowing and the weather reasonably cool will give fair results.

536. CASELLA, D. 634.3 : 575.252 : 632.8
L'apiatura del limone e la selezione gemmaria. (**Abnormalities in lemon fruits and bud selection.**)
Ann. R. Staz. Sper. Frutticoltura e di Agrumicoltura, 1933, **1** (N.S.) : 47-9, bibl. 7.

The present director of the chief Italian citrus research station here flatly denies Shamel's generally accepted theory that the ribbed, corrugated, seamed or otherwise abnormal characters noted on certain lemons and reproduced on progeny trees by asexual propagation are bud sports. In his opinion such characters are purely manifestations of virus infection. The virus is spread by insects, notably *Toxoptera aurantii*, hence control measures must be taken against such insects, and at the same time the greatest care must be taken to select only from healthy trees uninfected by virus. Actually the measures are approximately the same in practice as those advised by Shamel to prevent perpetuation of " undesirable strains ". The actual data on which the writer's assertion is based are not given.

537. CASELLA, D. 634.323-1.547.5
Un caso di neocarpia nel pompelmo. (*Citrus paradisi* Macf.) (**A case of precocious fruiting in grapefruit.**)
Ann. R. Staz. Sper. Frutticoltura e di Agrumicoltura, 1933, **1** (N.S.) : 77-84, bibl. 20.

The seedling was one among many obtained from seed of grapefruit received from Florida and sown at the end of April, 1926. Extremely little care was taken over watering both before and after germination. On June 18th a flower bud was noted on one of the plants. This developed, and after artificial pollination the ovary increased in size till July 10th, when it fell off. The article is mainly interesting as citing other cases of " neocarpy " observed in different plants by various workers. The very numerous factors which may possibly conduce to this phenomenon are discussed. " The nature, potential energy, consistency, aspect, physico-chemical composition, and richness of the soil, the temperature, humidity, length of daylight and intensity of light, the quantity and quality of nutrients are all external factors which markedly influence the act of flowering." The author states his intention, as occasion offers, of studying any special features to be found in the seed, the external conditions obtaining during the various stages of growth of the shoot and of the young plant, and the chemicals capable of inducing this phenomenon, which is now seen only occasionally.

538. BATES, G. R. 634.31-1.547.6 : 547.313.2
The development of the artificial colouring of oranges in Southern Rhodesia and its relation to wastage.
Mazoe Citrus Experimental Station Rept. for 1932, being *British South Africa Company publ.* **2**, 1933, pp. 103-50, bibl. 22.

In Part I the process of artificial coloration is explained, the methods usually employed are surveyed and suggestions are made for the practical application of the most suitable of these to Mazoe conditions. Part II reports on investigations in the relations of ethylene treatment to the development of wastage. In export consignments the increase in the amount of green mould in treated fruit was negligible. An increase in stem end rot can be definitely attributed to ethylene treatment. This can be controlled by removing the button of the orange, but unless the buttons are removed by the ethylene treatment alone there is little gain, since, when this removal is done by force prior to treatment, other rots gain an entry by way of the exposed tissues. There is considerable varietal difference in susceptibility to stem end rot. Temperature conditions in the fruit trucks between Mazoe and Cape Town are correlated with the amount of wastage. The amount of truck wastage compares unfavourably with that on shipboard and its more rapid development is attributed to the absence of refrigerated transport. The use of the short rail route to the port of Beira with the erection of a precooling plant there is suggested as an alternative to the long journey to Cape Town.

The following is also noted :—
CASELLA, D. La colorazione artificiale del limone. (**Artificial colouring of lemons.**) *R. Staz. Sper. Frutt. Agrum., boll.* **2** (N.S.), 1933, pp. 8.

539. BODENHEIMER, F. S., AND ASHBEL, R. 634.3-1.8-2.752
Preliminary note on the effect of manuring citrus trees in regard to the development of red scale. (*Chrysomphalus aurantii.*)
Hadar, 1933, **6** : 175-8.

The investigations were undertaken to discover whether the development of the red scale insect on citrus could be influenced by the nutritional salts absorbed by the tree. The trees were grown in sand to which the necessary salts were added and in salt solutions. Of the trees grown in sand the only ones which appeared at all healthy were those receiving a threefold ration of nitrogen in addition to a full complement of other salts. The trees grown in solutions were divided as follows. Those receiving—1. Complete solution, 2. less KCl, 3. less $MgSO_4$, 4. less KH_2SO_4, 5. less Ca $(NaO_3)_2$. Only 1 and 2 appeared in good condition. The trees were infected after the leaves had fallen when fresh ones were sprouting. The tests lasted two years and are still proceeding, but so far the results do not indicate that the alteration of fertilizer practice would be any protection against red scale.

540. HALL, W. J., AND FORD, W. K. 634.3-2.7
Notes on some citrus insects of Southern Rhodesia.
Mazoe Citrus Exp. Sta. Rept. for 1932, being *British South Africa Company publ.* **2**, 1933, pp. 1-51.

The pests are classified into three sections,—major pests or those which attack trees annually and require a general annual campaign for their control, in this case *Aonidiella aurantii* Mask. (Red Scale) and *Scirtothrips aurantii* Faure (Citrus Thrips) ; minor pests or those which render necessary the treatment of a greater or lesser number of trees annually (six species), and potential pests or those which might prove troublesome but have not done so yet (fifteen species). Full notes are given on the life history, habits, parasites and methods of control of the pests.

541. CASELLA, D. 634.3-2.314 : 575.252
Un tumore prodotto da *Bacterium tumefaciens* Smith e Town su arancia ovale e la selezione gemmaria. (**A tumour produced by *B. tumefaciens* on the oval orange of Calabria and its relation to bud selection.**)
Ann. R. Staz. Sper. Frutticoltura e di Agrumicoltura, 1933, **1** (N.S.) : 43-5, bibl. 6.

An orange with a large tumour on one side was examined at the research station and the tumour was found to be caused by the crown gall organism. The writer says that this is the first case of such infection in citrus found in nature in his personal experience, though Shamel in one of his articles on bud selection in the Washington Navel orange illustrates such a tumour. In the writer's opinion Shamel errs in considering it a case of bud mutation. He suggests that Shamel is very often wrong in his assumption of the presence of bud mutations, the phenomena observed being really due to disease of some sort, especially virus. He considers that even in citrus bud mutations are extremely rare. Such diseases as virus can of course be transmitted by vegetative propagation. [The actual data on which the above conclusions are based are not here described. —ED.]

542. BENTON, R. J. 634.3-2.952.2
Removing bordeaux spray from oranges.
Agr. Gaz. New South Wales, 1933, **44** : 683-4.

Black spot of Valencia oranges is controlled in N.S.W. by applications of bordeaux-oil spray (6-4-80-½) at blossoming time and again some weeks later, at a period when the mature fruit is still on the trees. The resulting deposit on the fruit must be removed before marketing. The method here outlined is suggested for use by those growers who pack their own fruit and is intended to take the place of the usual laborious practice of brushing the fruit. Of the various solutions tried by the Biological Branch of the Department of Agriculture, which consisted of 1% solutions of hydrochloric, acetic, lactic and tartaric acids, hydrochloric acid proved the most economical and satisfactory solvent of bordeaux spray deposit, though the others were also quite effective. In the course of the experiments immersion for 30 seconds in as dilute a solution as ⅛% hydrochloric acid completely removed the deposit, and when dry the fruit was a very bright orange colour. For commercial practice, however, it is recommended that the fruit placed in a piece of fishing net should be dipped in a 1% solution, and then plunged for an instant into clear water, subsequently being transferred to cases so constructed that rapid evaporation of water will occur. Commercial hydrochloric acid required 45 fluid ounces (2¼ pints) to 10 galls. of water to make a 1% solution.

543. LORD, E. L. 634.3-2.1
Citrus die back.
Citrus Industry, 1933, **14** : 7 : 6-7, 26.

The work of some of the chief investigators on citrus die back is discussed. From field observations in Florida the author inclines to Lipman's theory (*Science*, 1914) that die back is due to decreased nitrification in the soil and a subsequent absorption of ammonia direct by the plant. In Florida it is suggested that citrus soils should be brought as near neutrality as possible by the use of lime, bulky organic matter should be added to very alkaline and coarse sandy soils and good drainage provided. The more toxic forms of nitrogen should be avoided where soils are markedly distant from an optimum condition.

TROPICAL CROPS.

544. GREENSTREET, V. R., AND LAMBOURNE, J. 633.682
Tapioca in Malaya.
S.S. and F.M.S. Dept. Agr. general series, bull. **13**. 1933, pp. 78, bibl. 43, price 1 dollar or 2s. 4d.

Owing to its bad reputation for exhausting the soil the cultivation of tapioca (*Manihot utilissima*) in Malaya has hitherto been purposely restricted. In view, as is stated in the preface, of the

necessity for broadening the basis of Malayan agriculture and for not neglecting any crop which might prove to be an asset, an enquiry into the whole subject of tapioca cultivation was set on foot and is reported in this bulletin. The conclusion is reached that " handled in a rational manner, the tapioca industry constitutes an asset of not inconsiderable value ". Its impoverishment of the soil is no more than might be expected from any crop under the unscientific conditions in which it is usually grown, i.e. on soils of already low fertility and without manurial treatment. Besides containing chapters on cultivation the bulletin describes tapioca products and their manufacture and uses, and discusses costs of production.

545. MANN, H. H. 633.72-1.4 : 551.56

The climatic and soil requirements of tea.

Empire J. of Experimental Agriculture, 1933, **1** : 245-52, bibl. 17.

The article opens with an allusion to the curious restriction of the cultivation of tea as a commercial crop to a few areas only, situated, with the exception of a few recent plantings in Africa and Russian Georgia, mostly in south-eastern Asia and the islands adjoining. Due allowance having been made for the fact that the original habitat of the tea plant is centred in or near these districts and for the fact that an abundant supply of cheap labour is essential for the profitable working of the plantation, there remain the factors of climate and soil. Doubtless the precise requirements of the tea plant in connection with these have prevented its more universal distribution. In all countries where it is an established success the following conditions are present, and the measure in which they prevail will determine the suitability of an area. (1) Some rain should fall every month so that the soil never really dries further than just below the surface. (2) Total annual rainfall should exceed 60 inches. It is much higher in the best areas. (3) The temperature should not fall below freezing point or only very exceptionally. (4) The maximum shade temperature should not exceed 90°F. and should be accompanied by atmospheric humidity. Hot dry conditions are fatal. (5) The daily range of temperature should be small, particularly during the growing periods. (6) There must be an absence of strong dry winds. The soil characteristics essential for the cultivation of good tea are (1) Depth with good penetrability and porosity, the tea root being apparently powerless to penetrate hard or otherwise unsuitable subsoil. Many plantations have failed, it is considered, owing to unsuitable subsoil conditions. Waterlogging at any time of the year must be avoided. (2) Almost complete absence of lime. The average amount of lime extracted by hydrochloric acid from good tea soil in the principal tea districts of N.E. India does not exceed 0·12%. (3) A definitely acid reaction. The ideal pH value for tea soil seems to lie between 5·2 and 5·6. There are, however, successful exceptions with lower and higher values than these. Certain soil constituents necessary for the healthy growth of tea are discussed. Vigour depends on an abundant supply of nitrogen, though quality declines if the supply cannot be properly balanced by the available phosphoric acid and potash. Potash appears to check fungus and mosquito bug (*Helopeltis*) attack, and to prolong the growing period. It is noted, however, that recent experiments in Ceylon indicated no response to potash manuring. Sulphur deficiency produces tea yellows in Nyasaland. Further evidence is required to support the suggestions that there is a relationship between the amount of the lower oxide of iron in tea soils and tea quality, or that the presence of assimilable manganese in certain tea soils has a connection with the high quality of tea produced.

546. TUBBS, F. R. 633.72-1.523

A note on the variability of tea seedlings.

Tea Quarterly, 1933, **6** : 118-20, bibl. 1.

Identical pairs of tea seedlings can be obtained by " twinning ", a process in which a newly germinated seedling is split down the axis of the stem and root in such a way that each half bears one seed leaf. Each half will grow into a normal plant and any differences between them may be attributed to differences of environment and not of constitution. To show how far differences between tea plants are constitutional rather than environmental, pairs of twins were obtained from good jât bearers known to be relatively even in type. Six months after twinning

the heights (from the base of the junction of seed leaf with stem to the base of the apical bud) and the number of leaves (excluding fish leaves) were recorded for 187 pairs. The index of variability between and within pairs statistically worked out is :—between pairs height 1·918, leaf number 4·687 and within pairs height 0·743, leaf number 2·251. Applying the above data to the field it is evident that constitutional differences play an important part in producing variations and that rather than expect a weakly seedling eventually to develop adequately in the nursery when the more vigorous seedlings around have been already transplanted and competition eliminated, it would be better to discard it entirely.

547. TUBBS, F. R. 633.72-1.543
The growth of tea stumps.
Tea Quarterly, 1933, **6** : 98-103, bibl. 1.

The author describes an experiment to determine the effects of five methods of planting tea stumps. The plants used were uniform in height, 2 years old, and before the experiment were lifted with roots as intact as possible. The methods of planting were (a) intact as lifted, (b) with all green stems and leaves removed, but the roots untouched, (c) with all green stems, leaves and all lateral roots removed, the tap root remaining, (d) with the main stem cut back to six inches above the collar, the roots being left untouched, (e) as (d) but with all lateral roots removed. A statistical examination of the data for the establishment of the plants showed that methods (b) (c) (d) and (e) while not differing significantly among themselves all resulted in a significantly better establishment than (a). In (a) the green portions of the bush were left intact, so that the failures were probably due to excessive transpiration, the lateral roots evidently failing to supply sufficient moisture to counter this. Comparing (b) and (d) with (c) and (a) it appears that the presence or absence of laterals was immaterial in their case. Measurements made on (b) (c) and (e) 21 months later to determine the effect upon growth showed that while there was no significant difference between (b) and (c), (e) plants were distinctly shorter, this in part being due to the fact that the new growth was restricted to a length of 6 inches of stem above soil level, whereas in (b) and (c) new shoots were produced much higher up. The plants were then centred as follows (b) to three inches above the ground (c) to four inches above the ground (e) to two inches above the level of the stumping cut. Since no leaves were left on any of these trees when transplanted, all leaves found must be associated with new growth. The fresh weight of leaves from these prunings showed that (b) and (c) did not differ significantly, but that both had materially more leaves than (e). The difference being too great to be attributed to differences in pruning levels, it may be assumed to be a result of the treatments at planting. Significantly thicker stems were shown by (b) and (c) than by (e). It is concluded that plants from which only leaves and green wood had been removed at planting made more growth than plants headed back to six inches above the collar.

548. MILSUM, J. N., AND MARSH, T. D. 633.72-1.535
Propagation of tea from etiolated shoots.
Malayan Agr. J., 1933, **31** : 310-3, bibl. 6.

Twenty 3-year tea bushes at the Government Plantation, Serdang, were collar pruned to the surface in October. On the appearance of shoots which occurred in a month's time the stump was covered with earth to a depth of 4-6 inches. In January a band of thin copper wire was placed round the shoot near its junction with the stump, the earth being temporarily removed for the purpose. In April many of the wired shoots had produced roots. They were detached from the parent stumps and potted without ill effects. It is noted that a high starch reserve is necessary to induce the plant to produce a great number of shoots and that this may be obtained by resting the bush for two or three months before pruning. Other plants under experiment in this method of propagation are *Nephelium lappaceum* and *mutabile*. Citrus in the variety, *Achras Zapota*, coffee and rubber. So far tea, citrus and *Nephelium mutabile* have given good results.

549. TUBBS, F. R. 633.72 : 581.143.26
Resting the tea bush.
Tea Quarterly, 1923, **6** : 81-5.

The article discusses the best methods by which a scheme for restriction of output on Ceylon plantations may be turned to the advantage of the tea bush. The physiological processes governing the leaf and shoot production of the plant are described. Reasoning from these it appears that the most promising method is to rest the bush before pruning, thus enabling it to accumulate reserves which will be of considerable benefit later in reducing die-back etc., and in avoiding damage to the frame of the bush after pruning. The period suggested is 3 months for poor areas. With young tea the tendency will be to save expense by delaying pruning operations. This is not economically sound, since the bushes may then suffer damage from various causes (which are enumerated). Young tea should be treated normally till the bearing age is reached when it can then be rested and brought into production as required. In cases where production is temporarily to cease entirely, an increased expenditure on a careful cleaning up of each bush during pruning will result in much healthier plants when production re-commences.

550. MAYNE, W. W. 633.73
Annual report of the coffee scientific officer, 1932-3.
Mysore Coffee Exp. Sta. bull. **10**, 1933, pp. 16.

Work on leaf disease and the production of a disease resistant coffee. A method of laboratory inoculation on detached leaves is likely to prove a very valuable weapon in the attempt to produce a disease resistant coffee. Resistance appears to be dominant to susceptibility and the mode of inheritance to follow comparatively simple Mendelian lines. It is thought that as far as disease resistance is concerned immune coffees could be bred in a fairly short time, the problem being to combine the powers of resistance with other good coffee qualities. Studies on the phenomena of penetration by the germ tube of the fungus into the leaves of resistant and susceptible coffee strains have shown that resistance does not depend on any anatomical features of the host but probably on constitutional differences in the protoplasm of the host. *Crop losses during development* fell as last year into four groups, but this year there was too much overlapping for the groups to be sorted out clearly. The final percentage of fruit picked was 41·4% of the original bud, a figure only slightly different from last year when almost double the quantity of bud was produced at the start. Bud counts in connection with manurial treatments did not reveal any definite difference in setting due to the treatments. There was, however, a higher bud production in the nitrogen manured plots and a slightly lower loss in the early stages of the phosphoric acid manured plots. *Black bean.* This disease was not much in evidence during the year and material for study was scarce. As far as can be seen at present it appears to be bound up with a fundamental change in the tissues of the bean which occurs about August. *Spraying.* These experiments form the subject of a special bulletin and are abstracted in No. 555 of this number.

551. TRENCH, A. 633.73 : 581.144.2
Investigational work at the Scott agricultural laboratories. Preliminary study of root growth and root system of coffee trees.
Kenya Dept. Agr. Ann. Rept. for 1932, 1933, pp. 160-1.

The following is abstracted from the report of Mr. S. Gillett. During a period of drought two three-year-old coffee trees standing side by side at the Scott laboratories were observed to be behaving quite differently. Both trees carried a good crop, but as the drought continued A. collapsed and the crop yellowed and dropped, while B. continued to flourish, its full crop being succeeded by a heavy flowering. In washing out the root systems it was found that A., which collapsed, had a good lateral surface feeding system with a poorly developed vertical system, but owing to the drought no root activity was taking place near the surface. B. had a lateral system certainly no better than A. but its vertical root system consisted of a large mass of feeding roots extending to eight feet in depth. In addition to the increased moisture available

at this depth soil analyses indicated an appreciable amount of available nitrate. The reason for this variation between the two root systems was not apparent. If genetical, it suggests the important possibility of obtaining a deep rooted stock or variety for dry area coffee growing.

552. WAKEFIELD, A. J. 633.73
Arabica coffee : periods of growth and seasonal measures.
Tanganyika Territory Dept. Agr. pamphlet **9**, 1933, pp. 16.

The definite cycle of physiological activity in the coffee plant has an important bearing on cultural operations and the time at which they should be performed, yet it is often ignored. The whole subject is here carefully discussed and the various seasonal activities of the plant for medium altitudes in the Northern Territory of Tanganyika, together with the cultural and protective measures appropriate to the season, are graphically presented on two large charts which can be easily modified to suit other districts. Periods of active root growth of surface feeding roots occur in the drier months, January to March and June to October. Cultivation during these months is liable to destroy the surface rootlets, resulting in nitrate starvation and disturbance of the normal balance of the tree. Deep planting to avoid borer attack does not achieve its object and may also lead to nitrate starvation, since heavy rains and the waterlogging of the pits result in denitrification, and the later production and location of nitrates will occur mainly in the few inches of top soil well above the root system of the too deeply planted bush. Owing to the surface feeding root system deep rooted cover crops are advised, such as *Dolichos Hosei*, *Indigofera endecaphylla*, *Centrosema Plumieri* and *Pueraria phaseoloides*. They should not be turned in. With young coffee annual cover crops may be turned in if beyond the existing rootspread. Manures should be applied just before root activity begins and the carbohydrate nitrogen balance must be kept in mind. Heavy nitrogenous manuring has been known to suppress flower bud formation. Pruning should be done soon after flowering to allow the bearing wood as long as possible to mature for the formation of flower buds. It is noted that a vigorous annual-bearing coffee plant has little need for pruning but can be sufficiently treated by " handling " when the crop is on, i.e. pinching off the very young superfluous shoots. The possibility is discussed of checking biennial bearing by heavy nitrogenous manuring in the off year or by heavy pruning to prevent the formation of carbohydrates. The relation of soil moisture to flowering is outlined. If moisture is given before the flower bud or spike is sufficiently mature, it may cause the flower to open and drop. Irrigation for established plants should be delayed as long as possible. On young coffee early irrigation might be used to cause blossom drop and so save the cost of stripping. Intermittent flowering is hypothetically attributed to an insufficient nitrate supply preventing the development of all the buds at one time. As more nitrate becomes available later these dormant buds develop and produce a second flowering. The application of a nitrogenous fertilizer 4-6 weeks before the flower buds appear externally is suggested as a possible remedy for intermittent flowering. The bulletin closes with some remarks on pests and diseases. There are some interesting diagrams of coffee root systems showing the reactions of rootgrowth to various soil conditions and cultivation practices.

553. DE ANDRADE, E. N. 633.73-1.543.1
Cultura do café a sombra. (**Shading in coffee plantations.**)
Boletim de Agricultura, Zootecnia e Veterinaria, 1933, **6** : 87-94, 159-66.

The problem of shade or no shade in coffee plantations in Brazil is investigated. Evidence is produced to show that coffee grown under the shade of eucalyptus trees is greatly superior in yield, evenness of sample and size of berry to that grown in full sun. The quality of shade grown coffee when it reaches the cup is definitely softer and less bitter. The use of the shade trees in affording protection from frost and other severe climatic changes and in the reduction of erosion is pointed out. The set experiments were carried out at the Horto Florestal de Rio Claro, Brazil, while other observations were made on large coffee growing estates in the country. The analyses of the coffees were carried out by the Coffee Section of the Agricultural Secretariat, São Paulo. The variety of coffee is not stated.

554. LEDREUX, A. 633.73
La culture des caféiers à Madagascar. **(Coffee cultivation in Madagascar.)**
L'Agronomie Coloniale, 1932, (2) 21 : 121-36, 212-23 ; and 1933, (1) 22 : 7-20, 53-66, 92-9, 127-31, 156-62, 187-92 and 1933 (2) 22 : 13-22, 33-41, 77-84.
A description of the methods of coffee cultivation obtaining in Madagascar with suggestions for improvement, dedicated, the author says, principally to intending planters. Only established facts and practices are dealt with. There is no discussion of the problems on which modern research in coffee is now concentrating.

555. MAYNE, W. W., AND OTHERS. 633.73-2.941
Spraying of coffee in South India.
Mysore State Dept. Agr. Coffee Exp. Sta. bull. **9**, 1933, pp. 69, bibl. 38.
The necessity for spraying for various fungus diseases and to a certain extent for coffee borer is pointed out. Experiments have been carried out (with special reference to leaf disease) based on the nature of attack and time of appearance of the disease, to find the right time of spraying and the most effective mixture. Of all the mixtures tried, these being fully discussed in the bulletin, 0·5% bordeaux has proved the cheapest and safest. After testing a number of spreaders for their effect on the physical properties of the mixture, their efficiency against disease and their influence on copper retention on the leaves it is concluded that lime caseinate, though not the best, is the most suitable one available. Figures supplied by coffee planters are produced to show the increase in crop due to spraying. Spraying machinery is fully discussed. A simple device has been contrived whereby a D.S.P. sprayer can be fitted with four lines of hose instead of the usual two.

556. ANON. 633.74
Stoppage of research adversely affects Ecuador cocoa industry.
Trop. Agriculturist, 1933, **81** : 174, from *The Spice Mill*, 1933, vol. **56**, no. 7.
It is shown how the stoppage of research on cacao in Ecuador on account of financial stringency has resulted in the destruction by disease of one of the best varieties of cacao (Ecuador's principal export). In addition to this, witch broom disease was allowed to remain unchecked with the result that the country's exports were in 1930 less than half their volume in 1921. Resumption of research has shown that resistant varieties may be produced, but the damage already done must be irreparable for many years.

557. MCDONALD, J. A., AND OTHERS. 633.74-1.4
Studies in West Indian soils. VII. The cacao soils of Trinidad. A. Montserrat district.
Imperial College of Tropical Agriculture publ., 1933, pp. 50, bibl. 14, price 2s.
Twelve soil types have been recognized within the area, their distribution has been mapped in detail, and their characteristics are described.

558. MOLEGODE, W. 633.82/84
Notes on the cultivation of curry stuffs.
Trop. Agriculturist, 1933, **81** : 129-32.
The cultivation of the following plants under Ceylon conditions is described—chillies, coriander, cumin, fenugreek, onions and shallots, garlic.

559. ANON. 633.85
The tung oil tree does well in suitable districts.
Agr. Gaz. New South Wales, 1933, **44** : 615.
A note of the climatic conditions which appear most suitable to the tung oil tree (*Aleurites Fordii*) in New South Wales. These are an annual rainfall of not less than 28 inches, a heavier rainfall being preferable, a hot summer and a sufficiently cold winter to cause the tree to shed its leaves and to allow it a definite resting period. More than 12° F. of frost is injurious. In China the

districts in which it thrives best are often snow covered, but do not have more than 4° of frost. The fruit is described. Seed viability tests show that seeds should be planted during the season following their maturity.

560. AMMANN, P. 633.85
Huile *d'Aleurites Fordii* de Madagascar. **(Oil of *Aleurites Fordii* from Madagascar.)**
L'Agronomie Coloniale, 1933 (2), **22** : 97-102, bibl. 2.
A study of seeds of *Aleurites Fordii* grown in Madagascar. Owing to the characters of the seed and its contents varying with the country of origin this analysis was undertaken for the purpose of fixing a standard of constants for Madagascar grown seed. The oil was found to possess all the characters of the best tung oils. It was noticed that the fruits of *A. Fordii* fix a remarkable amount of potash, particularly those parts surrounding the kernel, and the suggestion is made that these parts together with the crushed cake should where possible be returned as manure to the plantations.

561. MILSUM, J. N., AND LAMBOURNE, J. 633.853.74
Gingelly.
Malayan Agr. J., 1933, **21** : 429-34, bibl. 3.
A description of the cultivation of *Sesamum indicum*, gingelly or sesame. It is thought in view of a recent import duty on this product into Malaya that it might profitably be grown by local small-holders, though in view of the low price it is improbable that it would be profitable with paid labour. The oil obtained from the seeds is much used for culinary purposes among Indians. Sesame is an annual erect herb growing to a height of 2 to 6 feet according to soil fertility. It is cultivated in India as an intermediate crop between padi seasons or intermixed with cotton and sorghum (*Andropogon Sorghum*). The seed can be sown broadcast or in drills 18 inches apart in soils of fine tilth, and to avoid sowing too thickly should be mixed with three or four times its bulk of dry sand or wood ashes. The only cultural attention required is thinning, at which time the opportunity should be taken to eradicate all weeds. The crop is ready to harvest in about 3 months from the date of sowing. Harvesting should be done when the first few seed capsules are bursting. Most of the capsules will be still green, but a delay in the harvesting will result in serious loss of seed. The harvested plants are tied in bundles and stacked in small heaps with heads pointing inwards in an open shed on a hard clean floor. When the seed capsules have turned brown the crop can be spread out in the sun on a clean floor to dry. The capsules will burst and the seed can be threshed out with sticks and winnowed. Before final storage it must be thoroughly dried. The oil is extracted locally by primitive hand or bullock operated presses. From experimental plots at the Government Experimental Plantation, Serdang, it was demonstrated that a fertile soil is necessary to procure good crops and that the land should be naturally fertile, since the low price of the commodity renders any expenditure on manuring uneconomic.

562. GRIST, D. H. 633.912 : 333.5
Nationality of ownership and nature of constitution of rubber estates in Malaya.
S.S. and F.M.S. Dept. Agr., economic series bull. **2**, 1933, pp. 26, price 50 cents.
This is the first occasion, according to a statement in the preface, that summarized information concerning the nationality of ownership and the constitution of rubber estates in Malaya has been put forward in a handy and accessible form. The report deals only with estates of 100 acres and over of planted rubber, it being concluded that all estates of under 100 acres are privately owned by Asiatics.

563. MANN, C. E. T., AND SHARP, C. C. T. 633.912-1.541.11
The history and description of clones of *Hevea brasiliensis*.
Rubber Res. Inst. of Malaya planting manual, No. **5**, 1933, sheets 34, price $2.
This manual describes in a concise form the more important characters together with records of yield of 14 different clones of *Hevea brasiliensis* that have been established in commercial

plantations in Malaya. The descriptions are materially aided by the drawings (by H. C. Chuan) which accompany each and illustrate the storeys, the leaf and the shape of the grown tree for each clone. In an introductory chapter illustrated examples are given of the terms used to describe the significant variations of storey, leaf, leaf stalk, etc., which variations being constant make up in combination the characters by which a clone may be recognized. The descriptions are so precise and the illustrations so exact, that if such a key can ever hope to be foolproof, this should stand an excellent chance.

564. HEUSSER, C. 633.912-1.534.4
Productiecijfers van Hevea marcotten in vergelijking met de overeenkomstige zaailingindividuen. **(Yield figures of Hevea marcots as compared with the corresponding seedling trees.)** [Dutch and English.]
Archief voor de Rubbercultuur in Nederlandsch. Indie, 1933, **17**, 13-23.

The yield of the marcots is about 75% of that of the seedlings. Possibly, however, the difference will become smaller as the trees grow older. In view of results obtained it is probable that the marcot is in no way inferior to the budding. Yet the fact should not be overlooked that certain stocks provided for buddings may be found to develop a root system superior to that of the budding's own, in which cases the budding may have an advantage over the marcot. V.d.L.

565. MAY, P. R. 633.912-1.538
Notes upon the rejuvenating of old rubber plantations.
Trop. Agriculturist, 1933, **81** : 137-52.

The author of these notes is the manager of the Dalkeith group of rubber estates in Ceylon. The substitution of budded rubber on unbudded estates yielding 300-400 lbs. per acre is advised, as also on poor yielding areas on good estates. Estates yielding 600-700 lbs. per acre with unbudded rubber can have their yields still further increased by annual or biennial manuring, but are otherwise best left alone. A programme for the rejuvenation of an estate of 1,000 acres yielding 500 lbs. to the acre is suggested as follows :—(1) Keep a permanent stand of 600 acres of the best rubber and manure annually or biennially. (2) Rejuvenate by planting budded rubber at the rate of 50 acres a year. The author estimates that this procedure will produce an eventual annual yield of 860,000 lbs. for the 1,000 acres. The total cost per acre of rejuvenation under Ceylon conditions up to the 7th year would be Rs. 350·00. The details of the expenditure are given. The choice of clones is discussed and tables are given showing the performances of the most promising foreign clones. " Proved Ceylon clones should shortly be available." The practice of budding in the field is compared with budding in the nursery. The author is undecided as to which is the better but remarks that his percentage of success in the field has been fully as high as in the nursery. For actual budding practices the reader is referred to modern text books. Of the various planting systems " Contour platforms " are recommended because they require little upkeep, they hold up all the water, which is particularly beneficial in a dry district, they make work easier for the tappers and so reduce costs, and they are more easily supervised. The platforms should be arranged so that the distance between them is always 20 ft. except on very steep land when it may be 25 ft. to allow of silt pits being dug at the back of the platforms if necessary. [Excellent photographs of the contour platform system accompany the article. —ED.] Holes should be cut the year before planting while the old rubber is still standing, so that leaves and soil may find their way into the holes during heavy rains. Emphasis is laid on the importance of filling the holes before planting with a good soil mixture. As it is the poorer land which will be chosen for rejuvenation, the soil may have to be transported from elsewhere. Cover crops should be sown as green manure as soon as a few acres of platforms are ready. The mixture and proportions recommended are :—*Centrosema Plumieri* 5, *C. pubescens* 2½, *Calopogonium* 2½, *Pueraria javanica* 1, sown at the rate of 5 lbs. to the acre. In addition the following should be sown and lopped when full grown, the loppings being forked in—*Crotalaria* 3 vars., *Tephrosia candida*, *T. Vogelii*, *Leucaena glauca*, *Clitoria*. A rate of 1 lb. per acre is suggested. If budding in the field is to be practised, seed should be raised in germinating beds near water and transplanted to the platforms. Four seedlings to each hole are advocated with

the eventual elimination of all but the strongest. Excellent results have been obtained by manuring the young seedlings with a mixture of sulphate of ammonia and concentrated superphosphate, 4 : 1, applied at the rate of 2-4 ozs. per plant every few months. By this means extra strong plants are obtained for budding which has always been highly successful, while most of the superfluous plants in each hole are good enough to be used in the following year's clearings. Budding should be possible 1-1½ years after planting. This method eliminates the need for a supply nursery. To extract the maximum amount of latex from the old trees before removal tapping both sides of the tree every third day is advocated, rising to alternate days two months before uprooting. This system has maintained a supply of 3 lbs. 6 ozs. of rubber per gallon of latex for over a year, which under other systems of " slaughter tapping " has dropped in a short time to under 2 lbs. per gallon.

566. FREY-WYSSLING, A. 633.912-1.541.5
Kenmerken voor taprijpe oculaties der Avros-Cloonen. (**Characteristics of tappable buddings of the Avros-Clones.**) [Dutch and English.]
Archief voor de Rubbercultuur in Nederlandsch-Indie, 1933, **17** : 1-12.
A description is given of twelve rubber clones, mainly of the bark characteristics. The author's conclusion is that, with a few exceptions, the clones described can be distinguished by means of the characteristics of their bark (Pl. I and II). It is noticeable that sometimes all the seedlings derived from a clone inherit the bark character in a marked degree. V.d.L.

567. MURRAY, R. K. S. 633.912-1.556.8
" Double-cut " tapping systems in Ceylon.
Trop. Agriculturist, 1933, **81** : 153-69.
This is a discussion of " double cut " tapping systems, based on information obtained as a result of a questionnaire circulated by the officers of the Rubber Research Scheme, Ceylon, to local proprietors and managers of rubber estates. The double cut systems are those whereby the tree is tapped on two half-spiral cuts on opposite panels, either every three days with a periodic rest (Double-Three or Sunderland), or every four days without a resting period (Double-Four or Healey). The systems were first introduced for the sake of economy during a time of financial depression and have proved so successful that many growers are considering their permanent adoption in place of the normal system of alternate day tapping on one half-spiral cut. Owing to the minuteness with which every aspect is examined an adequate summary is impossible in a necessarily short abstract. At the outset the attitude of the Research Scheme to the double-cut system was one of " cautious approval ", a position which appears to be unaltered after the digestion of the evidence obtained from the questionnaire. It reports that though it would be unwise to adopt a drastic tapping system unless replanting was contemplated, nevertheless there are at present no indications that the double-cut system is unduly severe, but it has, as yet, had only a very short trial. The Rubber Research Scheme is associated with experiments now in progress whereby the double-four, the double-three and alternate day tapping on one cut can be compared.

568. JONG, W. H. DE. 633.912-2.4
Het parasitisme van *Rigidoporus microporus* (Swartz) van Overeem. syn. *Fomes lignosus* Klotzsch, bij *Hevea brasiliensis*. (**Parasitism of *Rigidoporus*, etc., in *Hevea brasiliensis*.**) [Dutch and English.]
Archief voor de Rubbercultuur in Nederlandsch-Indie, 1933, **17** : 83-104.
Several inoculation experiments are reported showing that the fungus in question is only weakly parasitic to rubber. The presence of the mycelium on the roots of a tree is not always followed by development of decay, nor decay by the death of the tree. Similar observations were obtained from naturally infected trees in the field. Nevertheless there is no doubt that *Rigidoporus* is frequently responsible for the deaths in stands of Hevea, though probably such cases are associated with special environmental conditions. In this connection the characteristics of the soil may be of importance. Rubber on red soil and sand " permantang " areas appears to be

especially subject to the disease, where its incidence is very much higher than in the case of white soil stands. No direct relationships were to be observed between the incidence of the disease and the pH of the soil, the titrable acidity, the phosphate content, the humus content and the oxidation characteristics of the soil. There is some evidence that manuring may cause a slight increase of the disease, although confirmatory evidence on this point is required. Small trees are killed more quickly than larger ones. Variation in resistance may be the result of predisposing environmental conditions. The importance of the ground cover factor cannot be considered as definitely established, since Napper's method for estimating the status of the disease is open to question. The author refrains from dealing with the practical side of the question, since in his opinion the problem is one that can be only solved with a view to the special conditions obtaining in any particular locality. He stipulates, however, certain general aspects as the result of his work, which should not be overlooked in any effort to control the disease. V.d.L.

569. HAYES, T. R. 634.58
The classification of groundnut varieties.
Trop. Agriculture, 1933, **10** : 318-27, bibl. 9.

A classification of groundnuts according to their characters has been devised, by which it has been possible to classify some 35 varieties of groundnut growing in The Gambia. The characters used, each of which possess recognized grades, are corolla colour, red colouring matter on standard, colour of calyx, calyx teeth, red colouration of stem, leaf attributes, hairs on petiole, condition of flowers at 3 p.m., colour of testa. Characters found to be of no value in classification are length of seed, angle between rachis and petiole (morning and evening), angle between petiole and stem (morning and evening). The mean oil content of all bunch varieties was less than that of all runner varieties, but not significantly so. An analysis of the inheritance of characters was made of the F2 generation of a Valencia × Sine cross and the results tabulated. " No characters that exhibit clean cut segregation show any connection with one another. Eight characters, five of which are vegetative, are found to be connected with yield." The prospects of evolving a type immune to rosette disease are at the moment unpromising.

570. BADAMI, VENKATA RAO, K. 634.58
Groundnut: soil, rainfall, cultivation, varieties under cultivation, pests and diseases.
J. Mysore Agr. & Experimental Union, 1932, **13** : 60-81, and
Groundnut: its products, composition and uses.
Ibidem, **13** : 115-34.

In these two articles are described the cultivation of the groundnut, the manufacture and disposal of its products as practised in the various countries where groundnuts are grown commercially being discussed as well as the application of these principles to Mysore conditions.

571. JACK, H. W. 634.6
Note on the flowering of the nipa palm under cultivation.
Malayan Agr. J., 1933, **21** : 314-5.

The studies were made by the staff of the Nipa Distilleries of Malaya Ltd. in co-operation with the Department of Agriculture. The 24 palms, which were 10 years old, were divided into two sections, one half being on " lenggaddai " (*Bruguiera parviflora*) land and the other on " piai " (*Acrostichum aureum*) land. The observations extended over a period of 6 months and are briefly as follows :—The flowering sheath from its first appearance takes 4-6 weeks to attain a length of 1 ft. From this stage the male flowers open in from 14-27 days and the duration of the male phase of flowering is from 4-10 days, the shorter period being for cool moist weather. The female flowers open 1-2 days before the male phase begins. Binding and beating of the fruit to accelerate juice exudation can be done four months after the beginning of the female phase. Untapped fruits are mature in six months from the beginning of the male phase. No differences could be found in the various phases of flowering between palms on " lenggaddai " and palms on " piai " land. Artificial pollination was not necessary but proved beneficial in producing heads more

uniform in size and larger and with a lower percentage of failures to mature. It can be made an estate practice without difficulty. Insects were not observed to have affected pollination, which the observers take for granted to be brought about by wind. From other authoritative sources the presence of numerous insects in the neighbourhood of nipa palms is described, but without reference to them as pollinating agents.

572. HUTSON, J. C. 634.61-2.78
The coconut caterpillar (*Nephantis serinopa*).
Trop. Agriculturist, 1933, **81** : 67-9.
The life history and habits of this pest of coconuts in Ceylon are described, and control measures are suggested. These consist in removing and immediately burning all leaves bearing the slightest sign of caterpillar attack. Fortunately in the early stages it is the oldest leaves which are attacked. A coloured plate showing the insect in all its stages accompanies the article.

573. FAWCETT, H. S., AND KLOTZ, L. J. 634.62-2.4
Diseases of the date palm (*Phoenix dactylifera*).
Univ. Calif. Coll. Agr. Exp. Sta. bull. **522**, 1932, pp. 47, bibl. 27.
The following diseases and their control are of importance in California and are discussed at some length :—the *Diplodia* leaf stalk and offshoot disease, the " decline " disease (probably a nutritional trouble), black scorch (*Thielaviopsis paradoxa*), brown spot of fruit (*Alternaria* sp. and *Helminthosporium* sp.), blacknose of fruit (probably nutritional). Notes are also given on the Bayoud disease (possibly *Cylindrophora albedinis*) and Khamedj (*Mauginiella scaetae*), neither of which are found in California.

574. STOUT, A. B. 634.653 : 581.162.3
The pollination of avocados.*
Florida Univ. Agr. Exp. Sta. bull. **257**, 1933, pp. 44, bibl. 15.
The flowers of avocado have two distinct periods of opening or anthesis. At the first opening the flowers function as females, at the second opening as males. These successive openings of the flower take place in a daily sequence of sets on different days and cover different hours of the day. Avocados also fall into two groups, those whose first or female opening is in the forenoon and second or male opening in the afternoon of the second or third day (called here the A group) and those whose first period of opening is in the afternoon and whose second period is in the morning of the following or of the second day (the B group). Thus, while this arrangement renders cross-, inter- or self-pollination by members of the same group impossible, it allows of a daily reciprocation of pollination between the two groups. It is important, therefore, since the avocado is not apogamous, that plantations should consist of members of both A and B groups, if fruit is to be obtained. In this bulletin lists are given of each class and various abnormalities of behaviour as regards opening periods are discussed.

575. STAHL, A. L. 634.653 : 581.192
Changes in composition of Florida avocados, in relation to maturity.
Florida Univ. Agr. Exp. Sta. bull. **259**, 1933, pp. 61, bibl. 9.
" The results and analyses of the physical and chemical characteristics of the leading varieties of Florida avocados throughout the life cycle for three fruiting seasons and grown at various sections of the State are presented in tabular form." No single characteristic or set of characteristics of physical appearance could be correlated with maturity. The pressure tester as used for peaches, etc., was not suitable for diagnosing maturity in avocados. The changes in sugar protein and ash contents during ripening are too small to be used as evidence of maturity. The moisture content varies with climatic conditions and affects the other characters so that it becomes impracticable to use the values calculated on the wet basis for measures of maturity.

* See also *H.A.*, 1932, 2:1:58.

There is definite correlation between specific gravity of the whole fruit and the oil and fat content, an increase of fat decreasing specific gravity. In the Guatemalan and Hybrid varieties the fruit was mature when the specific gravity reached 0·98 or lower and in the West Indian varieties at 0·96 or lower. The fat content of the Guatemalan and Hybrid varieties at maturation was two or three times that of the West Indian varieties. Avocados stored until soft show an increase in oil, fat, and hydrolysable sugar and a decrease in specific gravity, moisture, free reducing and total sugars over those analysed at once while hard.

576. CHEESMAN, E. E., AND OTHERS. 634.771/3
The Cavendish group of banana varieties with special reference to Lacatan.
Trop. Agriculture, 1933, **10** : 218-21, bibl. 14.

From the evidence of field comparisons, fruit storage trials and a common complete sterility the banana varieties Lacatan, Bumulan, Giant Fig and Masak Hijau may be assumed to be one variety. The Mestica of Brazil is also probably this variety. It is proposed in future to use only the name Lacatan for this group. The Lacatan is closely related to the dwarf banana, *Musa Cavendishii*, and to certain intermediate forms including Congo. This assemblage of dwarf, semi-tall and tall forms may be termed the Cavendish group.

577. ROMAGNOLI, M. 634.771/3
Coltivazione del banano nella Somalia italiana. (**Banana growing in Italian Somaliland.**)
L'Agricoltura Coloniale, 1933, **27** : 361-73 and 433-46.

The varieties cultivated for their fruits are Giuba, Johnson of Brazil and Siriana, all being *Musa sinensis*, and the Zanzibar variety of *Musa sapientum*. The last is said to resemble Gros Michel and until recently was the most popular. With increasing exports to Europe, however, Giuba has displaced it in popularity. Giuba is considered to resemble Canary bananas both in size and taste. It is picked some 20 days before maturity. It then stands transport well, and its fruits fetch more in the market than those of Zanzibar. Its productive capacity is about double and it begins to bear 3 or 4 months earlier, i.e. in the 11th or 12th month from planting. Being only 6 ft.-8 ft. high it is less liable to damage by monsoon. Johnson of Brazil and Siriana are both in the experimental stage. The method of propagation found most successful and recommended is as follows :—The trees are selected for vigour, healthiness, regularity of fruit and number of fruits per whorl. From them either offshoots or false stems which have already flowered and have a couple of buds are selected. The soil is thoroughly loosened to the depth of a metre or just over a metre and removed, leaving a hole about a metre square. The bottom is covered to the depth of 30-40 cm. with loose stones or failing that rough, waste vegetable matter such as cacao leaves, prunings, etc., to ensure drainage. This is covered with a 3-4 cm. layer of soil and on the top is set a 20-25 cm. layer of organic manure. Soil is added and the offshoot planted 30-40 cm. below ordinary ground level. The soil is then heaped up forming a small mound of 5-6 cm. which subsides gradually and disappears. Later the offshoot is cut at 10-15 cm. above soil level and the soil is ready for irrigation. When irrigation is possible, planting can be done at any time, otherwise it should take place at the beginning of the rainy season. Failures can be removed about a month after planting, when they should be replaced. Notes are given on the necessary cultural operations throughout the whole life of the tree. Wind breaks are essential, *Cassia florida* and *Casuarina tenuissima* being found most useful in this respect. Green manuring has been found successful especially with *Vigna sinensis*, *V. cylindrica*, *V. sinensis* var. *Cifinor*, *Phaseolus Mungo*. The most important pests are *Aspidiotus destructor* and certain eelworms. Among diseases the black spot disease thought to be due to *Helminthosporium musarum* is now under investigation, though neither its ravages nor those of another fungus which causes rotting of the central leaves which surround the flower bud are particularly serious. Notes are given on flowering and finally on the best methods of packing and shipping overseas.

578. HYATT, J. B., AND TURNER, C. W. O. 634.771/3-1.547.6
The commercial ripening of bananas in New Zealand. Parts I and II.
New Zealand J. Sci. Tech., 1932, **14** : 152-72, bibl. 13, and *Ibidem*, 1933, **15** : 117-27.

The bananas grown in the Cook Islands and shipped to New Zealand in green condition in boxes are apparently Cavendish and certain hybrids as yet unnamed. A ripening process is necessary before they can be retailed to the public, and it is stated here that this ripening process is very inadequately performed and much loss occasioned to retailers owing to the lack of proper ripening rooms. Part I of this paper by Hyatt sets out the conditions (ascertained after much careful research by the author) necessary for successful ripening of these bananas under New Zealand conditions. Part II by Turner describes the regulatory equipment by which such conditions may be maintained uniformly over the ripening period. Details are also given for the construction of a room for ripening bananas on a small scale.

579. WARDLAW, C. W., AND MCGUIRE, L. P. 634.771/3-2.3/4
Cultivation and diseases of the banana in Brazil. Part II. Diseases.
Trop. Agriculture, 1933, **10** : 211-7, and 255-9, bibl. 11.

Part I (*Trop. Agriculture*, 1933, 10, 192-7, *H.A.*, 1933, 3 : 3 : 411) described the cultivation of the banana in Brazil, the varieties being chiefly Cavendish and Giant Fig. In Part II the principal diseases are discussed. The most serious is the bacterial wilt disease caused by *B. solanacearum* E.F.Sm., which was particularly in evidence on the rich humus soil known as tabatinga. Remedial measures suggested consisted of killing all infected stools by the application of heavy gas oil, followed by an attempt to improve soil conditions by liming and aeration. A new virus disease (not bunchy top) was observed. It has points in common with a new virus disease recently described from Australia and is regarded as potentially serious. Infected plants should be immediately destroyed. Other localized maladies were a brown rot of bulbs, *Marasmius* stem and root rot, blackhead and debility diseases. Measures for the amelioration of planting conditions as a means of eliminating these diseases are outlined. Pitting disease, a principal source of wastage of Brazilian cargoes was investigated and formed the subject of an earlier paper (*Trop. Agriculture*, 1932, 9 : 193-5).

580. PARK, M. 634.771/3-2.4
The oil treatment of plantain diseases.
Trop. Agriculturist, 1933, **81** : 86-90, bibl. 2.

To avoid the trouble and expense of uprooting the clumps of disease infected bananas various methods of killing them have been tried from time to time. A satisfactory and cheap method has been evolved whereby the diseased plants are cut down to within 4 inches of the ground and the stumps and surrounding ground are given a dressing of a heavy gas oil, at the rate of one or two pints per plant. The oil is described as having a specific gravity of 0·864 with closed flashpoint 170–180° F.

581. SIMMONDS, J. H. 634.771-2.48
The squirter disease of bananas.
Queensland Agr. J., 1933, **40** : 98-115, bibl. 7.

The causal organism of this disease in Queensland has been identified by the Imperial Mycological Institute as *Nigrospora sphoerica* (Sacc.) Mason. The author has found a number of different strains of this fungus which fall roughly into two groups. These are described. According to Goddard* the disease is not detectable in the green banana and does not develop until the fruit reaches the ripening rooms. Even then there is often no outward sign on an infected fruit, though occasionally there is bluish black discoloration over badly affected parts. On squeezing the fruit, however, a stream of a dark semi-fluid is ejected from the stalk or side. If the fruit is cut before this stage is reached, a dark watery rot is found extending from the placental region

* Goddard, E. J., " Squirter disease in bananas," *J. Council Sci. and Ind. Res.*, 1929, 2 : 27-31.

and running various distances longitudinally. The work of previous investigators supported by evidence obtained by the author shows that low temperatures during growth or transport have a definite bearing on the development of squirter. Since, however, the optimum temperature for growth of the fungus is above that for development of the disease, it is conjectured that the effect of chilling produces some physiological change in the fruit, which renders the tissue more suitable to a rapid development of the fungus, or that the prolongation through cold of the stage of ripeness at which the fungus makes most progress gives more time for the development of the disease. It is not produced in the hard green or soft ripe fruits. Control measures are discussed under three heads :—*Sanitation*, namely the removal of dead leaves in the plantations and of the small spathe remaining attached to the bunch top before it dries ; cleanliness in the packing shed ; the burning of rank herbage in the vicinity of the packing shed and plantation ; a discontinuance of the practice of standing the cut branches on grass or banana trash. *Prevention of infection*—spraying the fruit as it comes from the plantation with a weak solution of formaline, or a fumigation under tarpaulin with gaseous formaldehyde liberated by potassium permanganate ; packing the fruit in hands rather than in fours or singles since infection has been proved by Bagster* to take place largely through the stalk end (the opposition of the trade to this method based on the smaller count of fruit in a case would have to be overcome) ; avoidance of bruises and wounds in handling (even the forcible bending of the fruit stalk being found to cause a bruise, which is a common point of entry of fungal organisms). *Reducing the effect of cold.* The methods suggested are choice of a warm site for the plantation ; covering the fruit with bags during cold weather ; picking when warm, and prompt dispatch; the lining of cases with paper ; rapid ripening by modern methods.

582. CHONA, B. L. 634.771/3-2.4

Preliminary investigations on the diseases of bananas occurring in the Punjab and their method of control.

Indian J. Agr. Sci., 1933, 3 : 673-87, bibl. 16.

The following types of diseases were observed. In the plantation—main stalk rot, black tip or finger tip, pseudo stem rot, leaf spot, peculiar curvature of the midrib and crumpling of leaves. In the " curing pit " and storage—green ripeness, stem end rot, finger-stalk rot, unsightly skin blemishes. With but three exceptions, it is stated, there is no literature on the diseases nor any reliable classification of Indian bananas. The various diseases mentioned above are briefly described and the most important studied at some length. The causal organisms appear to be species of *Gloeosporium* and *Botryodiplodia*. The effect of temperature and humidity on the incidence of the disease is clearly shown and correlated with the cultural behaviour of the parasitic fungi. The propagation of healthy suckers from diseased plants can be achieved by removing the affected suckers, and planting the underground corm, which is usually free from infection, first dipping it in 2% copper sulphate solution. Storage diseases may be checked by low temperature storage 15°-20° C. (59° to 68° F.) and by smearing the cut end of the bunches with a thin coating of vaseline.

583. WATANABE, S. 634.774 : 581.144.2

Studies in the root of pineapple varieties, with special reference to the Smooth Cayenne and Ôhishu. [Japanese-English summary.]

Communications Hort. Institute, Taihoku Imp. Univ., No. 22, 1932, pp. 9, bibl. 6, being reprinted from *Formosan Agr. Review*, 1932, No. 303.

Various writers are quoted to show that pineapple varieties which have a rapid root growth are less susceptible to root rots than most possessing roots of slower development. The author compared by experiments in water culture and root observation boxes the root development of the susceptible Smooth Cayenne and the resistant variety Ôhishu. The Smooth Cayenne had the greater number of roots, but they were shorter and less branched, root growth was slower and ability to produce new roots was less marked. The work was carried out in Formosa.

* Young, W. J., Bagster, L. S., and others, " The ripening and transport of bananas in Australia," *Council of Sci. and Ind. Res. bull.*, 64, 1932.

584. WATANABE, S. 634.774 : 581.144.2 : 551.52
Effect of temperature upon the root development of pineapples. (1) The maximum, minimum and optimum temperatures for the elongation of main roots. [Japanese-English summary.]
Communications Hort. Institute, Taihoku Imp. Univ., No. **24**, 1932, pp. 13, bibl. 21, being reprinted from *Formosan Agr. Review*, 1932, No. **305**.
The author in a series of experiments (the technique is not described in the summary) found that the maximum, optimum, and minimum temperatures for root growth in pineapples was not the same for all varieties. Approximately, however, the maximum is 41°-43° C., optimum 29°-31° C. and minimum 5°-7° C. After one week at 5° C. the roots died ; they survived 2 days at 1° C.

585. SUBRAMANIAM, T. V. 632.951.1
The insecticidal properties of indigenous vegetable fish poisons.
J. Mysore Agr. & Experimental Union, 1932, **13** : 57-60.
The following plants used locally as fish poisons were tested for their insecticidal properties by the Mysore Dept. of Agr.—*Mundulea suberosa*, *Pongamia glabra*, fruits of *Randia dumetorum* and *Lasiosiphon eriocephalus*. *Mundulea suberosa* showed the most toxic qualities on mango hopper nymphs (*Idiocerus* sp.), grasshoppers, cattle lice and fleas, the potato beetle grub (*Epilachna*) and various kinds of aphids. *Pongamia* oil resin soap, made in the laboratory sprayed in a 2% solution against green bug (*Coccus viridis*) of coffee gave 100% mortality of nymphs and adults in 48 hours, thus comparing very favourably with fish oil resin soap.

586. MOWRY, H. 635.9
Ornamental trees.
Florida Agr. Exp. Sta. bull. **261**, 1933, pp. 136.
This bulletin is a useful and well illustrated guide book to the ornamental trees of the tropics and subtropics. Included is a long and interesting list of the native trees of Florida in which those of special value for ornamental planting are starred.

587. COSTER, CH. 581.144.2 : 634.973.491
Wortelstudiën in de tropen. IV. Wortelconcurrentie. (**Root studies in the tropics. IV. Root competition.**) [German summaries.]
Landbouw, 1933, **9** : 1-48, bibl. 39 ; also *Tectona*, 1933, **26** : 450-97, and *Korte Mededeelingen v.h. Boschbouwproefstation*, **35**.
A continuation of the studies on rootgrowth in the tropics. Previous articles have appeared in *Landbouw*, 1932, 8 : 146-94, and **369-464**, abstract in *H.A.*, 1933, 3 : 1 : 6. The subject in this article is the teak tree, and its root system, from the point of view of root competition, is studied in various soils such as marl, sandy loam, and chalk, in pure stands and in mixed cultivations and natural undergrowth. The root competition in mixed plantations is ingeniously illustrated by diagrams on transparent paper which can be viewed separately to present a picture of the root system of any one species in the plantation. Superimposed on others they show the extent of the competition when grown in conjunction.

588. PYNAERT, L. 667.211.4
La mangrove congolaise. (**Congolese mangroves.**)
Bull. Agricole du Congo Belge, 1933, 24 : 185-207, bibl. 59.
This paper is a discussion of the information at present available and of the possibilities for future commercial exploitation of the Congolese mangroves. The list of species is still incomplete as also is exact information as to the zones occupied by the different kinds. There still remains much of botanical interest to discover. The importance of the mangrove in preventing erosion

and even in reclaiming land from the sea is pointed out. The author, who is Chef du Bureau of the Belgian Colonial Office, states his intention of having the whole subject thoroughly investigated by specialists sent out for the purpose.

589. DENNETT, J. H. 631.4
Studies in Malayan soils. I. The classification and properties of Malayan soils.
Malayan Agr. J., 1933, **21** : 345-61.
This paper is the first of a series of four in which it is proposed to give an account of some of the important factors governing soil fertility in Malaya and of the results of certain researches on the subject which have been undertaken in the past three years. There is a general introduction by the Director of Agriculture, Dr. H. A. Tempany, in which the application of certain modern views on soil science to Malayan conditions is discussed.

590. EDEN, T. 631.459
Soil erosion.
Tea Quarterly, 1933, **6** : 78-80 and 111-4.
The various injurious effects of soil erosion are described. Experiments at the Missouri Experiment Station are regarded as being the most complete in showing how much and in what form loss of nitrogen occurs. In these experiments more than enough nitrogen to raise a good crop of any farm produce was lost annually. The results indicated that in climates with a heavy rainfall organic nitrogen is at least as easily lost through erosion as soluble nitrogen. The crop studies of Mosier and Gustafson with soil from eroded ground are described. Here eroded soil in pots grew exceedingly poor crops, but with the addition of nitrogen, or, better, nitrogen and phosphate in combination the results were strikingly good. Phosphate and potash without nitrogen gave only small increments. In conclusion is pointed out the useless expense of endeavouring to preserve the potential nutrient wealth of the soil by the addition of manures without proper precautions against erosion in districts subject to this menace to cultivation. [The origin of the references is not given.—ED.]

591. WAD, Y. D., AND TEMBE, G. C. 631.459
A note on erosion in black cotton soils.
Agriculture and Live Stock in India, 1933, **3** : 238-45, bibl. 27.
A short note, illustrated by some remarkable photographs, on the effects of erosion on comparatively level ground at Indore. Drains, grass borders, rat holes and dry weather cracks and the movement of dry surface soil, when subjected to heavy monsoon showers, are instrumental in starting erosion. The problem of prevention is still unsolved but possible lines for remedial measures are indicated.

The following also are noted :—

SMITH, E. H. G., AND OTHERS. **Plant breeding in Southern Nigeria.** *Trop. Agriculture*, 1933, **10** : 312-7, bibl. 12.

HARDY, F. **Cultivation properties of tropical red soils.** *Empire J. of Experimental Agriculture*, 1933, **1** : 103-111, reprinted in *Trop. Agriculturist*, 1933, **81** : 187-94.

TEMPANY, H. A. **The rubber industry in Malaya in 1932.** *Malayan Agr. J.*, 1933, **21** : 297-309.

CORBETT, G. H., AND MILLER, N. C. E. **A list of insects with their parasites and predators in Malaya.** *S.S. and F.M.S. Dept. Agr. scientific series bull. No.* **13**, 1933, pp. 15.
The list is compiled from the records of the entomological laboratories from 1920-32.

STORAGE.

592. ROSE, D. H., AND OTHERS. 664.84/85
The commercial storage of fruits, vegetables and florists' stocks.
United States Dept. Agr. circ. **278**, 1933, pp. 40, bibl. 32.
A series of brief summaries of the essential average storage requirements of a number of fresh fruits, vegetables and flowers of commercial importance. It is announced that the bulletin is primarily for general practical reference and that the conditions described are not absolute or final but rather the safe limitations under which the various products can ordinarily be stored. About 59 kinds of horticultural products are separately dealt with.

593. BANGA, O. 664.84/85.037
De bewaareigenschappen van tuinbouwproducten. Speciaal in verband met bewaring in gekoelde ruimten. (**Keeping qualities of horticultural produce, with special reference to cold storage.**)
"Fonds Landbouw Export Bureau 1916-18," Wageningen, 1933, pp. 168, bibl. 194.
In this publication various problems are discussed in connection with the cold storage of horticultural products, allusion being made to no less than seventy fruits, flowers or vegetables. The scope of the work can be gauged from the chapter headings and sub-headings which are as follows. I. *Factors influencing keeping quality.* 1. Introductory discussion on factors influencing keeping quality. 2. Influence of storage temperature on the produce. 3. Influence of the atmosphere in the storage room on the produce. 4. Choice of variety as a factor in storage. 5. Influence of growth conditions on the keeping quality of the produce. 6. Influence of maturity at time of harvesting. 7. Influence of handling on keeping quality. II. *Wastage in cold store.* 1. Causes of wastage. 2. Prevention of wastage. III. *Artificial ripening of fruit.* IV. *The keeping qualities of particular varieties.* [In this chapter a section is devoted to each class of hardy fruit and some tropical ones. Flowers and vegetables are treated more generally.—ED.]

594. THORNTON, N. C. 665.84/85.035.1
Carbon dioxide storage. III. The influence of carbon dioxide on the oxygen uptake by fruits and vegetables.
Contrib. Boyce Thompson Inst., 1933, **5** : 371-402, bibl. 15.
The oxygen uptake as well as the carbon dioxide output by various plant tissues held in a confined atmosphere was determined by gas analyses. Experiments were carried on for various periods of time over a wide range of concentrations of CO_2. Results show the response of the various plant tissues to storage in 0% to 75% of CO_2. The oxygen uptake and carbon dioxide production were increased in the potato, decreased in asparagus shoots and shelled Lima beans and not significantly altered in the carrot. The varying effects of storing at different concentrations were also noted in the case of onions, tulips, beetroots, asparagus, lima beans, bananas, strawberries, and are here detailed.

595. THORNTON, N. C. 664.84/85.035.1
Carbon dioxide storage. IV. The influence of carbon dioxide on the acidity of plant tissue.
Contrib. Boyce Thompson Inst., 1933, **5** : 403-18, bibl. 12.
Materials tested were potatoes, onions, tulip bulbs, beets, carrots, asparagus, bush Lima beans, bananas, strawberries, apples, peaches, oranges, tobacco, tomato. Treatment of the above with CO_2 in the presence of O_2 at 25° C. for various periods of time resulted in a decided decrease in the hydrogen-ion concentration of the sap extracted from them. The pH differences were determined with the quinhydrone and glass electrodes and with indicators. Storage in air after treatment resulted in the restoration of the pH value at the same level as that of the untreated control tissues.

596. ROSE, D. H., AND LUTZ, J. M. 664.85.13 : 632.1
Injury to pears caused by paper liners impregnated with sodium silicate.
J. Agr. Res., 1933, **47** : 153-62.
A brown discoloration occurring in russeted pears after packing is traced to alkaline substances in the sodium silicate contained in the " excelsior " filled pads and corrugated paper used to line the boxes. The moisture of the pears causes the alkaline substances to go into solution and produce the injury.

597. BATES, G. R. 664.85.31 : 632.48
Wastage during the 1932 export season.*
Mazoe Citrus Exp. Sta. Rept. for 1932, being *British South Africa Co. publ.* **2**, 1932, pp. 150-76, bibl. 10.
The most common cause of decay among exported Rhodesian oranges was the blue mould *Penicillium digitatum* Sacc. Investigation showed that the system of cleaning the fruit by brushes was a very important factor in the incidence of wastage. No wounded fruit passing through the brushes could escape a heavy infection while all fruits received a coating of spores, which were thus in readiness to infect any subsequent injury. In experimental inoculations with *Penicillium digitatum* it was observed that infection was produced only when the fruit was inoculated through the oil vessels. The reactions of citrus wastage fungi to the essential oils in the skins of citrus fruits has not yet been studied to any great extent. It is known, however. that the spores of sour rot and anthracnose fungi are rapidly killed by the oils, whereas the spores of *Penicillium* are more resistant probably because of the nature of the spore wall. Why oranges should be more liable to infection of *P. digitatum* and *P. italicum* when inoculated into the oil vessels than into the surrounding skin tissues is still a matter of conjecture.† Experiments with oils of known purity and investigations into the relation of time of harvesting and other factors governing the toxicity of the oil are needed. Inoculation experiments showed differences between varieties in the rate at which wastage develops and that rate also appears to be correlated with temperature conditions during harvesting.

598. DAVIES, R. 664.85.3.037
Survey of temperature conditions and gas concentrations in refrigerated chambers on arrival at Southampton in ships carrying citrus from South Africa.
Union of South Africa Dept. Agr. sci. bull. **117**, 1932, pp. 28.
The writer considers as the results of his observations that there is much room for improvement in conditions on board ship, largely in the direction of greater consistency of conditions obtaining in different chambers and even in the same chamber at different times. He thinks that the considerable danger of cold injury due to the use of side grids would be obviated by the use of roof grids. Even when all the apparatus is apparently ideal, a great deal must depend on the arrangements made for the air distribution. Actual performance can only be determined by observation.

599. WINSTON, J. R. 634.3-2.4 : 546.273.33
Reducing decay in Florida citrus fruit by the use of borax.
Citrus Industry, 1933, **14** : 10 : 6-7.
Owing to a recent hurricane in Florida much citrus fruit may be expected to be scarred, bruised, etc., in such a manner as to render it more readily accessible to fungal infection. The article is written to assist those whose fruit may be affected. Of all the post harvest antiseptic treatments none excells borax in fungicidal properties and in cheapness. The main Florida decay diseases are blue and green moulds and stem-end rots. The treatment advocated is dipping the fruit

* See also 530, 538.
† See also 530.

in an 8% borax solution warmed to 110° F. The temperature of the rind of the fruit should be above the saturation temperature of the concentration used, otherwise sufficient borax is unlikely to adhere to the fruit. It is of vital importance that only the shortest possible interval should be allowed between picking and the application of the fungicide. It is suggested that many growers who in the past have found the borax treatment unsatisfactory have not fully appreciated this. Application should not be delayed till after the fruit has passed through the colouring rooms. The presence of borax does not retard rate or quality of colouring or accelerate wilting. Borax is not very effective in checking decay of dead ripe oranges, i.e. those on the point of falling from the tree. Under all usual conditions, however, borax will retard decay not only during preparation for market and in transit, but during the period normally required for distribution, retail and ultimate consumption.

600. WINSTON, J. R. 634.3 : 546.273.33 : 547.313.2
Colouring borax-treated citrus fruits.
Citrus Industry, 1933, **14** : 10 : 16, 18.

When borax treated fruit is introduced to the colouring room, a set of conditions not usually encountered arises. The chief difficulty lies in maintaining the correct degree of humidity when the fruit and containers are brought in wet. If the containers are dry and the fruit wet, the matter is less difficult. A radiator is efficient in removing excess moisture and is therefore recommended as a source of heat for warming up wet fruit. The liberal use of steam may result in enough condensation to wash off much of the borax residue particularly in the lower layers of the boxes, and fruits thus affected will decay almost as much as if they had never been treated. The presence of wet borax-treated fruit also adds to the difficulty of maintaining optimum gas dilutions during the early part of the colouring, since it is necessary to introduce as much fresh dry air as possible into the room in order to dry the fruit within reasonable time.

601. WARDLAW, C. W. 664.85.337
The storage behaviour of limes.
Low Temperature Station, I.C.T.A., Trinidad, 1933, pp. 23, price 2s. 6d.
[Author's summary and recommendations also published in *Tropical Agriculture*, **1933, 10**, 246-7.]

[The following abstract is taken from the summary in *Trop. Agriculture*, the actual report submitted to the Empire Marketing Board only coming to hand after going to press.—ED.]
The possibility of placing both green and yellow fruits on the market was kept in mind. Five varieties were used, the West Indian Lime, the East Indian, (Khagzi Nimbu), the Philippine and two Trinidad hybrids, T1 and T6. This last alone proved unsuitable. Yellow fruit (Grade A) is very juicy, attractive in appearance and will keep with care at 45° F. for two months. Turning or partly coloured fruit (Grade B) fails to colour evenly after picking, at least without artificial aid. Full grown, pale green (Grade C) is suitable for the green lime industry for 15-20 days at 45° F., with a few days during retailing at a higher temperature. After this it tends to colour slightly and so spoil the uniformity of the sample. Almost full grown dark green (Grade D) except T1, is excellent for green lime markets and may be held in cold storage at 45° F. for two months. A lower temperature causes chilling and disfiguration of the rind. A relative humidity of not less than 85% is necessary. The fruit should be promptly packed after harvest, since pre-storage delay, especially in hot dry weather, will cause depreciation. Grading and brushing is harmless if only a short storage time is required, but if a long storage life is necessary the injuries caused by the machines may be of considerable importance. Improvements in existing machines are visualized which may lead to a reduction of these injuries. The need for care in packing and handling is emphasized. Shrivelling and dehydration are the main cause of wastage. Ordinary citrus wrappers having proved useless, a close wrapping of cellophane paper was found greatly to reduce loss of weight. Other wax impregnated or waterproofed papers might be useful.

602. NELSON, R. 664.85.3 : 632.1
Some storage and transportational diseases of citrus fruits apparently due to suboxidation.
J. Agr. Res., 1933, **46** : 695-713, bibl. 24.

The investigation mainly concerned storage spot or pox disease, though some experiments are reported on brown spot and brown stain. The effects of varying the atmospheric composition were studied and results noted. Oranges and grapefruit were found to vary in susceptibility according to their degree of maturity, green fruit usually being the more susceptible. The use of oiled wrappers gave contradictory results. The observed effect of acetaldehyde and fruit esters on oranges and grapefruit suggests that some substance with a similar action may be concerned in causing or accentuating injury which follows storage of these fruits at low temperatures.

The following also is noted :—
WESTON, B. J. **Picking, grading and packing of citrus fruits.** *Cyprus Dept. Agr. bull.* **2**, 1933 (Horticultural series), pp. 16.

603. JOACHIM, A. W. R. 634.1/7-1.547.6 : 547.313.2
The artificial colouring and ripening of fruit.
Trop. Agriculturist, 1933, **81** : 75-85, bibl. 16.

This article deals with the artificial colouring and ripening of tropical and subtropical fruits from the point of view of the small grower who has not such facilities for the work as are now usually provided on large commercial estates or in co-operative packing houses. The necessary ethylene gas may be imported in cylinders (into Ceylon), but the author considers such expense unnecessary for small quantities of fruit and describes a simple method of making and using the gas, which could be carried out by the grower. To prepare ethylene gas ethyl alcohol is heated " with an excess of concentrated sulphuric or phosphoric acid to a temperature of about 165° C., a little sand or a few pieces of glass being added to the container to prevent bumping. The evolved gas is passed through caustic soda to free it of sulphur dioxide and is then quite suitable for use". 20 c.c. of alcohol and 60 c.c. of concentrated sulphuric acid will produce about $\frac{1}{4}$ c. ft. of gas. The fruit to be coloured, after being washed and dried, is placed in an airtight chamber having a door and a window for ventilation. The gas is then admitted through a small opening in the proportion of 1 to 1,000 parts of air. A lower proportion of gas to air is effective but takes longer. If mixed with air in a greater proportion than 3% by volume, it forms an explosive mixture. The optimum temperature within the chamber is 70° F. The relative humidity should be from 75-90% according to the variety of fruit. The humidity can be increased by the introduction of an open vessel of water into the chamber and reduced by the presence of quicklime, sand or caustic soda. The chamber is kept closed for 8-10 hours after the first charge, then well aired for 2 hours and given a second charge, the charges being repeated at the rate of two to three a day till the fruit is coloured, the length of time for this varying with the degree of maturity and with the variety. The effect on ripening is discussed. From data produced by other workers combined with his own observations the author is of the opinion that, while the ripening of citrus fruits is not hastened by the process, that of other fruits, for instance mangoes, plantains, pineapples, is hastened. The astringency of mature sapodillas is entirely removed. A few practical hints gained from local experience on variations in the treatment most suitable for certain varieties is given. *Grapefruit, oranges, pineapples* and *sapodillas* should be treated as described above. *Lemons* require a curing temperature of 65° F. with an 80% humidity. They should not be coloured to full depth. The process takes from 5 days upwards. *Plantains* require a humidity of 90%, diminishing as the fruit ripens to 75%. The process takes up to three days. *Mangoes* need a lower concentration of gas, 1 in 2,000 being sufficient. *Tomatoes* need a temperature of 65°-75° F. with a fairly high humidity to prevent shrinkage. A lower concentration than 1 in 1,000 may be used. The length of process depends entirely on degree of maturity and the variety : three to six days is usual. Mention is also made of the acetylene process. With this satisfactory coloration can be obtained by exposing the fruit to a gas

mixture of 1 in 1,500 to 1 in 3,000 for periods of 4 hours followed by 2 hours ventilation. The carbide is placed in the chamber in the ratio of 1 oz. to every 75 c. ft. of free air space after making allowance for the space occupied by the fruit crates, and small quantities of water are added from outside by means of a " clip device ". The cost of both methods is infinitesimal.

604. WARDLAW, C. W., AND MCGUIRE, L. P. 664.85.771
Banana storage. An account of recent investigations into the storage behaviour of several varieties.
Empire Marketing Board publ. **72**, 1933, pp. 35, bibl. 5, price 1s.

The authors in presenting this further report on the storage behaviour of bananas consider that it constitutes an important advance in the practical knowledge of banana problems. The behaviour of a number of varieties in storage under commercial conditions at the low temperature Station, I.C.T.A., Trinidad, was investigated to assess their value and suitability for export. Giant Governor, probably a tall mutant of the Cavendish or Governor banana, has given promising results in four bulk storage trials. It appears owing to its toughness of skin much more suitable for market transport than the ordinary Governor. It developed chilled defects after 6 days at 33° F. but at 58° F. ripened to an attractive deep yellow. Reaping at the correct moment, " heavy ¾ full ", is essential or abnormal colour effects develop. Its texture and flavour were found good. The ordinary Cavendish or Governor proved very subject to mechanical injury and therefore unsuitable for export. These plants had been grown on poor soil enriched with manure. Fillbasket, which held well at 53° F., ripened attractively at 70° F. Its bunch habit and thin skin, however, do not render it suitable for any but local trade. In bulk storage trials Gros Michel showed uneven ripening. It is not known at present whether this defect is cultural or seasonal. The new College Hybrid I.C.2 produces on relatively poor land small bunches with short closely packed fingers. Its flavour, texture of flesh and colour of skin are good and it shows resistance to bruising. It is highly resistant or immune to Panama disease. Further storage trials with bunches grown on good cultural soil are needed. The varieties Giant Fig, Lacatan, Bumulan, Martaban and Masak Hijau, already thought for other reasons to be identical, gave further support to this view by the great similarity in the characters developed during ripening in store. Pitting disease was observed on Giant Governor and on Governor varieties.

PACKING, PROCESSING, PLANT PRODUCTS.

605. CARNE, W. M., AND TURNBULL, R. F. 634.11-1.564
Australian export apple cases.
Council Sci. Indust. Res. Division of Forests Products, tech. paper **10**, 1933, pp. 48.

The purpose was to determine the comparative merits of the Canadian case and the Australian dump as regards the protection given by them to their contents and their ability to withstand normal hazards of handling, the ultimate objective being to obtain data which might justify the adoption of only one type and size of case. Sufficient tests of protective values were found to be (1) a packing bruising test, which consisted of simply opening the case after packing and lidding and recording the bruising, and (2) a dropping test, which consisted of dropping packed cases on selected faces from predetermined heights and for a varying number of drops. Every feature of the two types of case are discussed including variations in wood used, dimensions, etc., and their respective merits are judged. It is found that the dump-shaped case gives better protection than the Canadian case. Unduly tight packing is found to be a source of bruising, and all-round corrugated strawboards are effective in reducing it. It is considered essential that the net weight of apples should not be less than 41½ lbs. per case at point of shipment, complaints having been received that the weight per case of Australian apples was less than that of American apples. It is recommended that a standardized dump case, not less than 18″ × 9″ × 14¼″ in internal measurements, should be used for export. Detailed specifications are given of such a case.

606. WILLIAMS, C. G. 634.774-1.556.1 +1.564
Harvesting and packing of pineapples.
Queensland Agr. J., 1933, **40** : 116-20.

The importance of correct methods of selecting mature fruit is emphasized. For Queensland the Fruit and Vegetables Act of 1927 lays down the following maturity standard:—"In the case of pineapples, fully developed fruit which during the months November to March shows a distinct tinge of yellow colour at the base, and during the months April to October is quarter yellow coloured at the base." Harvesting should be done with a sharp knife leaving not more than $\frac{1}{4}$" of stem at the butt of the pine. The fruit being very easily bruised, care should be taken to see that it is dry, particularly at the stem end. As a protection against water blister the cut stalks should be rubbed either in benzoic acid powder or in a mixture of benzoic acid and kaolin, the kaolin not to exceed four times the weight of benzoic acid. At the packing shed fruit should be stacked tops up to facilitate drying. Each case should be filled only with pineapples of uniform size. Grading consists of packing uniform sized pineapples to give certain counts. The packing case should be $24\frac{3}{4}$" by 12" by 12". The case contains different counts according to the size of the fruit. The counts of 11 to 14 are packed in layers of one line only, all the tops of each layer pointing one way, the successive layers being superimposed head to tail with the butts touching the side of the case. Contents of 18-24 are packed in two rows to each layer the butts of the opposing rows touching opposite sides of the case, with the tops between the opposing fruits.

607. ISHAM, P. D. AND FELLERS, C. R. 634.76 : 577.16
Effect of manufacturing and preserving processes on the vitamins of cranberries.
Mass. Agr. Exp. Sta. bull. **296**, 1933, pp. 19, bibl. 41.

These investigations were made on the American variety *Vaccinium macrocarpon*. They show that the fruit when fresh is a good source of vitamin C. Cold storage for 4-6 months produced a loss of 20% of this vitamin, for 7-10 months 60% to 70%. Actual freezing did not destroy the antiscorbutic properties. Evaporation, pulping or straining for sauce manufacture and jellying all had a deleterious effect on vitamin C content. No significant amounts of vitamins B, D or G were found in cranberries.

608. NICHOLS, P. F. 664.85.047
Method of sun-drying fruits.
Calif. Agr. Ext. Series circ. **75**, 1933, pp. 37.

The writer gives a very full account of the methods recommended for drying the following fruits: apricots, peaches, pears, figs, prunes, grapes, cherries. He considers that thinning is of importance in producing fruit of the required quality and that to produce the best possible dried product the fresh fruit must be of fully developed flavour, well coloured and of maximum sugar content. Since figs and prunes are generally harvested by picking from the ground after falling, the ground should be softened and smoothed in preparation. He describes in detail the processes necessarily carried out before the actual drying. These include the elimination of waste parts and any cutting, pitting, dipping in lye, sulphuring or other treatment necessary to make the fruit dry quickly and without decomposition or objectionable change in colour. Diagrams are given of the apparatus used in each case. The actual process of preparing and drying each fruit is then described with notes on the probable labour and materials involved. Finally directions are given on the proper handling of fruit after drying.

609. CALDWELL, J. S., AND OTHERS. 664.85.25.037
Varietal adaptability of peaches to freezing in small consumer packages.
Fruit Products J., 1933, **12** : 366-71, bibl. 6.

Fifty-six varieties of peach from the U.S. Department of Agriculture farm at Rosslyn, Virginia, were selected for trial. They were graded for maturity, peeled, washed, halved and stoned under identical methods. All were packed in 50% sugar syrup in airtight or non-airtight containers within 30 minutes of peeling. The two containers are described. Freezing was

accomplished by the slow process, about seven hours being required to lower the temperature to freezing point at the centre of the container. Comparative studies between peaches frozen by the slow method and by a very rapid method were made and the latter was found to result in the greater discoloration and loss of flavour on thawing. There were great differences in colour, texture and flavour between varieties, and the 56 varieties from non-airtight containers were finally grouped as follows, the airtight containers being used as controls. I. Nine were of dessert quality as regards texture, preservation of natural colour and characteristic flavour and odour. II. Eight had a less satisfactory texture and showed some discoloration on exposure to air. III. Nine were fairly good in texture and flavour but subject to such rapid and extensive oxidation in air that they would be unmarketable except in airtight containers. IV. The remaining varieties were not up to dessert quality. A table gives detailed results of the examination of the 56 varieties after freezing and storage at 17° for 5 months in consumer packages.

610. GEORGI, C. D. V. 634.6
A system of control for oil palm factories.
Malayan Agr. J., 1933, **21** : 413-28, bibl. 2.

The author outlines a simple system of control against loss suitable for large factories dealing with the crop from 10,000 acres or more. He recognizes that in a factory of this size control can also be obtained in steam and power consumption, but in this paper he has restricted himself to a consideration of the factors regarding maximum recovery of products. Describing the need for control in large establishments he shows that in an estate of 10,000 acres in full bearing with an annual output of 16 cwt. of oil and 4 cwt. of kernels per acre, prices being £18 per ton and £8 per ton for kernels, a variation of only ½% in the output of palm oil is equivalent to a difference of approximately £700 per annum. This sum would reasonably cover the upkeep of the factory laboratory necessary for proper control, and as a result the factory would have the chance of ensuring a maximum revenue as a result of the introduction of an efficient system for the control of loss.

NOTES ON BOOKS AND REPORTS.

611. MORTON, J. W. 634/5 : 664.84/85
Fruit and vegetable growing for canning.
Fenland Press, 1933, pp. 46, price 1/–.

Short notes on the cultivation of twenty-six fruits and vegetables suitable for growing for sale to canning factories. Attention is given to choice of variety, and to the special requirements of the factories, where these differ from those usual in produce grown for market.

612. SMITH, K. M. 632.8
Recent advances in the study of plant viruses. With a foreword by F. T. Brooks.
J. & A. Churchill, London, 1933, pp. xii. + 423, with coloured frontispiece and 67 text figures, price 15s.

About a hundred years ago it was observed that certain types of foliage variegation could be transmitted from scion to stock by budding. That such infectious variegation might sometimes denote serious disease was not comprehended for some time and the scientific study of diseases induced by the transmission of infectious sap is of comparatively recent origin. During the years 1887 to 1890 Erwin F. Smith, in his investigations of peach yellows and rosette in America, found that healthy trees could be infected by inserting buds taken from diseased trees, thus demonstrating that these diseases could be transmitted by vegetative union. Shortly afterwards (1892) Iwanowski showed that the infective principle of tobacco mosaic was a filter-passing virus, a conclusion that was confirmed a few years later by Beijerinck. About the same time it was discovered that foot-and-mouth disease in animals was also caused by a filterable virus. As a result of these discoveries interest in virus diseases was roused and now, as the author of the work

under review points out, " there are more than a hundred diseases considered to be due to viruses and they include many devastating disorders affecting plants, insects, fish, birds, domestic animals and man." Plant virus diseases had received comparatively little attention in this country until 1927 when the situation was discussed at the Imperial Agricultural Conference, and a resolution passed recommending that facilities should be provided for further investigation into these diseases. As a consequence the Ministry of Agriculture and the Empire Marketing Board supplied funds for the purpose and the impetus given to the study of plant viruses was soon felt. The complex nature of the virus diseases of Solanaceous plants (potato, tobacco, tomato) is under investigation at Cambridge, Rothamsted and Cheshunt, while other research stations in Britain have undertaken the study of the diseases of the hop, black currant, raspberry, strawberry and tulip. Many important crop plants are subject to virus infection. There are serious virus diseases of sugar cane, rice, wheat and maize, of many fruits (in tropical as well as temperate regions), vegetables, forage plants, hops, cotton, and a number of ornamental plants. Certain weeds are also attacked and in some cases the viruses of weeds can be transmitted to cultivated plants. The descriptions of these diseases have appeared in numerous papers in various languages and many of them in journals not easily accessible. Apart from articles describing specific diseases, papers dealing with plant viruses in a broader aspect have appeared from time to time but, until the publication of Dr. Kenneth Smith's book no attempt has been made to bring together in one volume of this size the mass of information that has accumulated in recent years. Those workers engaged in investigating virus diseases and all who are interested in the scientific aspect of agricultural and horticultural practice will therefore welcome this book. There are chapters dealing with the physical properties and physiology of plant-viruses, and the insect vectors concerned in their transmission, while in the later chapters descriptions are given of all the important plant virus diseases. The importance of these diseases in horticultural practice may be illustrated by reference to those which infect fruit trees and bushes commonly cultivated in Britain and other temperate countries. " Top fruits " in Britain appear to be singularly free from virus diseases, although several of these maladies are found on stone fruit trees abroad. In America various virus diseases of the peach are known under the names mosaic, yellows, rosette, little peach, red suture, and phony. The recently described " Pox " of plums is widespread in Bulgaria, and " what is apparently the same disease has been recorded in Kentucky, Minnesota, Illinois, Holland, Czechoslovakia, Australia and South Africa. " Buckskin " is an important disease of the cherry in California. Curl, streak and various forms of mosaic in raspberries, as found in America, are described, " but," the author says, " there is little information of their occurrence in Europe ; only ' raspberry mosaic ' has been recorded in England." It may be pointed out, however, that raspberry mosaic has been recorded for Germany, Norway, Holland, Poland and Czechoslovakia, and it has been under investigation in this country for some years, although a detailed description of the " types " met with in Britain was not published until shortly after the book was issued. On p. 115 *Amphorophora rubi* is mentioned as a vector of leaf curl in the raspberry but this is inconsistent with the statement on p. 348, that no curl infection was obtained with this aphid. " Reversion " in black currants is treated very summarily, in seven lines, with no description of symptoms, although this is a disease which has been investigated for some years at the Long Ashton and East Malling Research Stations. There is no reference to the papers by Ridler and by Lees (*Ann. Appl. Biol.*, 1924 and 1925) nor to those of Darlington and of Amos and Hatton (*Jour. of Pomol.*, 1927 and 1928). The disease has been reported on the Continent from Holland and Denmark as well as Germany. An account is given of strawberry xanthosis in America, of the very similar disease, yellow-edge, found in this country, and of witches broom. Strawberry " Dwarf " is also included, but recent work by Brooks in Florida has shown that this is identical with " Crimp " now known to be caused by a nematode. The author himself has carried out important work on the viruses of potato and tomato. One chapter, devoted to a description of potato virus diseases, includes a discussion of the complex inter-relations of the viruses associated with the various forms of potato mosaic. Other workers may not all accept his views on the " dual nature " of tomato stripe (streak). To turn from these diseases that are of a more or less serious nature, it is interesting to read that " Many of the attractive variegated tulips now to be seen are merely mosaic-diseased

specimens of a uniform self-coloured variety. Thus the valued Rembrandt variety consists of diseased specimens of the variety Princess Elizabeth." The only mention of control measures is a passing reference (p. 12) to the need for breeding resistant varieties. There is no discussion of the value of " roguing " or of raising virus-free clones for propagation in those crops that are raised vegetatively. The book is illustrated by 67 good text figures (many of them from photographs that are " original or reproduced from the writer's own work "), and there is a coloured frontispiece illustrating the Spotted Wilt disease of the tomato. This disease was discovered a few years ago in Australia ; it is now very destructive in this country on the tomato and it infects also a number of ornamental plants. As a treatise on a group of diseases very destructive to plant life this book should be read by all who are interested in the cultivation of ornamental and crop plants ; it is indispensable to those who wish to keep abreast with modern methods in plant pathology. H.W.

613. International Institute of Agriculture. 631/5(072) : 551.566.2
Les Institutions d'experimentation agricole dans les pays tempérés.
(Agricultural research institutes in temperate climes.)
Int. Inst. Agriculture, Rome, 1933, pp. 306, price lira it. 20.

This is a companion volume to that published two years ago on research stations in the tropics. (*H.A.*, 1933, 3 : 1 : 135.) It should be noted that no attempt is made to include or at any rate give details of research stations dealing essentially with animal husbandry, agricultural engineering, dairying or poultry, since these have already, or will form the subject of special publications. The editors have obviously had to rely on the replies to a comprehensive questionnaire sent out by the Institute with the result that the detailed information given is necessarily somewhat patchy, very much more information being given in some cases than in others. This, however, was inevitable and does not detract from the great value of the work to anyone wanting to know where research work on any given subject is being carried on in any particular country. The text is in French.

614. Horticultural Education Association. 634/5(058)
The H.E.A. Year Book for 1933. Vol. ***II.***
R. T. Pearl, Editor, S.E. Agr. Coll., Wye, Kent, pp. 126, price 3s. 6d. post free.

The second issue of this year book well maintains the standard set last year. For the horticultural pilgrim articles on horticulture in Scotland and Lincolnshire suggest new lands to explore, while the philosopher may muse contentedly with Mr. Kent on the merits and demerits of nitrogenous manuring of apples, or with Mr. Bagenal on heretical tendencies among cherries or again may perpend with Mr. Furneaux as to which particular soil will best suit the orchard of his dreams. Immediate practical problems are not neglected, concise and useful notes being given on choice of weed killers, on growing for the cannery, on control of chrysanthemum eelworm. Essential principles of apple storage are discussed as are also the uses of electricity in horticulture. Horticultural instructors will be grateful for the hints by Mr. Hart on methods of instruction on fruit growing in a farm institute, for Mr. Christian's interesting account of horticultural educative work on the fringe of a large town and for Mr. Pearl's description of how to get the good news " across " by the aid of what in old days would have been called a magic lantern, but now being much more magical and certainly more illuminating has many and more formidable names. The last article is illustrated and includes useful notes on sources of further information, materials, etc.

615. S.S. and F.M.S.* 634.6
Reports of the Research, Economic and Education Branches for the year 1932.
S.S. and F.M.S. Dept. Agr. general series bull. **14**, 1933, pp. 86.

This report covers the research activities of the Department of Agriculture for the year 1932. Notes of investigations likely to be of particular interest to readers of *Horticultural Abstracts* are

* Editor, H. A. Tempany.

given below. *Oil palms.* At Serdang manurial experiments with bearing palms are in progress and have been enlarged. Results of large scale pollination experiments for the year ending September, 1933, show 100% crop increase for artifically pollinated fruit bunches over naturally pollinated bunches. An experiment to show the damage, if any, caused by epiphytic growths on the palm trunks was begun. Experimental work supervised by the Department on certain private estates consisted of yield recording for 600 (later reduced to 399) palms; cross and self pollination of selected palms, the resulting seedlings to be planted at the Government Experiment Station, Serdang, and on a private estate; study of natural pollination. Wind borne pollen appears to be inadequate in quantity and no insect carriers have yet been identified, though the strong smell of aniseed given off by both male and female inflorescences suggests that some part may be played by insects. *Areca nuts.* At the coconut Experiment Station, Klang, areca nuts are under examination for flowering and fruiting characters. Pollination studies have also been carried out with similar results as for coconuts (q.v.). *Nipa palms.* Preliminary studies of flowering and fruiting in nipa palms to ascertain the conditions necessary to induce maximum flow of juice. *Coconuts.* An investigation was concluded into the composition from the point of view of nutriments, of the leaves, inflorescences and nuts removed from palms in the course of estate practice (*Malayan Agr. J.*, 1932, 20 : 358-64, bibl. 4). Cultural experiments indicated good results from a form of " trench " cultivation and from ridge mounding [details are not given.—ED.]. A method [also not described.—ED.] was found for securing self pollination without the necessity for the preservation of pollen. Ten pages are devoted to a report on copra research. The investigations cover a wide field. *Tuba root* (*Derris*). Analysis of different species of *Derris* showed that *D. elliptica* offered the best possibilities as a source of rotenone, samples being found to contain 7% of crude rotenone with a total ether extract of 25%. It seems probable, however, that rotenone content is affected by enviromental conditions. Analysis indicates that rotenone is distributed in the proportion of 30% in the cortex to 70% in the endoderm. Work on the isolation of other toxic compounds present in derris is in progress (see also *Malayan Agr. J.*, 1932, 20 : 498-507, bibl. 11; *H.A.*, 1932, 2 : 377). *Fruits.* Preliminary trials with the etiolated shoot method of fruit tree propagation are encouraging for limes, lemon, sapodilla and rambutan.

616. FIJI.* 634.77 +634.61 +634.3

Annual Bulletin of Divisional Reports, 1932.

Fiji Dept. Agr., 1933, pp. 70.

A record of the work of the Department of Agriculture during 1932. Only selected portions dealing with horticultural experiments are noted here. *Bananas.* Work has been devoted primarily to methods of control for leaf spot disease (*Cercospora musae* Zimm.), which caused heavy loss during the season under review. Spraying experiments were carried out with half and full strength burgundy mixture, and the following oil emulsions :—2% raw and 2% boiled linseed oil, 2% and 3½% coconut oil. " The disease was checked but the results were indefinite." *Coconuts.* Records from the F I generation of 59 pedigree trees, taken at monthly intervals, show great variation in number of spathes produced yearly, number of female flowers, numbers of pollinated flowers reaching maturity, character of the tree, whether monoecious or dioecious, periods of flush and rest and possible causes of premature nut fall. The crosses in bearing are 56 Malayan Dwarf × Niu laka, an indigenous dwarf, and 3 pure Malayan Dwarf crosses. It is noted that the number of female flowers per spathe is by no means a sure guide to the number of fruits ultimately to be harvested. *Citrus.* The colouring, grading, wrapping and packing of citrus fruits in standard cases stencilled with the " count ", combined with strict attention to careful harvesting and handling, work undertaken commercially for the first time in Fiji, was carried out under the supervision of officers of the Agricultural Department. The increase in price from 14s. to 25s. per case for Fijian citrus fruit in New Zealand showed the success of these operations. The additional cost to the shippers was only 11½d. per case.

* Editor, A. C. Barnes.

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